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VOL. XLIV., No. 9. FRIDAY, FEBRUARY 28, 1908.

President Roosevelt is somewhat out of touch with the commercial interests of the country, but we presume he takes cognizance of the fact that earnings of manufacturing industries and railroads alike are lower than they were a year ago at this time, and that urgent need of economy confronts every manager. What was the object, therefore, in including in his recent letter to the Interstate Commerce Commission the following statement?

> "If the reduction in wages . . . is caused by misconduct in the past financial or other operations of any railroad, then everybody should know it, especially if the excuse of unfriendly legislation is advanced as a method of covering up past business misconduct by the railroad managers, or as a justification for failure to treat fairly the wage-earning employees of the company."

How long does the President suppose the wage-earning employees of a wicked railroad would stay in its employ if it reduced wages below the figure which these employees could obtain elsewhere? And if economic conditions are such that the supply of labor exceeds the demand, how long does he suppose wages will remain at the plane to which they have been forced in a long series of years when the demand exceeded the supply? Between January 1 and June 30, 1907, the *Railroad Gazette* reported 81 cases of wage increases, involving 67 roads, although no special effort was made to obtain a complete list. Did anybody investigate these increases, on the ground that the vested owners of the properties—the employers of labor—were not treated fairly thereby? We imagine that such investigation would have proved futile; demand was forcing wages up, and the increases had to be paid if men were to be secured and traffic moved. The converse of this (as seen by everybody except Mr. Roosevelt and Mr. Gompers) becomes true when demand ceases, and labor seeks employment. But the President is not opposing natural laws unarmed; he has a pretty formidable club. His letter may be paraphrased as follows: If you reduce wages, you thereby become subject to a governmental inquisition on the assumption that you are unable to continue overpaying your employees because your property is overcapitalized. Choose, therefore, between your present wage scale and an inquisition which will damage your credit!

Low prices in the stock market, idle freight cars and business depression do not delay the maturity of financial obligations which are outstanding against railroads any more than they do those outstanding against individuals. According to a table given in the *Journal of Commerce* there are maturing during the next five months a total of $35,948,000 in bonds and $36,880,460 in notes of steam railroads, the notes including a few of the larger equipment trust instalments. These figures do not include $15,000,000 notes of the Interborough Rapid Transit Company maturing in May, $16,500,000 notes of the Underground Electric Railways of London maturing in June, or $10,818,000 bonds of a subsidiary of the Manhattan Elevated, of New York City, maturing July 1, 1908. The principal railroad note issues maturing are Missouri Pacific, $6,000,000, already refunded; Rock Island, $6,000,000, maturing in April; Erie discount notes, $5,000,000, maturing in April, and Pennsylvania equipment trust instalments estimated at $6,000,000, maturing in June. The largest bond issues are $6,000,000 Delaware & Hudson 6 per cent. bonds maturing this month, $4,700,000 Great Northern 5 per cents maturing in April, and $4,993,000 Oregon Short Line sevens maturing July 1. The Erie has also $2,500,000 in sixes and fives maturing on that same date. The present great difficulty of raising new railroad capital is resulting in the production of some novel forms of corporate securities. The means by which the Missouri Pacific refunded its $6,000,000 two-year 5 per cent. notes which matured February 10 was by an issue of the same amount of two-year 6 per cent. collateral convertible notes. These notes were secured by $12,000,000 Kansas & Colorado Pacific 30-year 6 per cent. mortgage bonds dated February 1, 1908. It is these bonds into which the notes are convertible at par. We are informed by the bankers that these are the first convertible notes ever issued. It is interesting to observe the various ways in which they are made attractive to investors. They are a direct obligation of the Missouri Pacific. They are secured by twice their par value in new mortgage bonds on 1,450 miles of the Missouri Pacific system. They are also convertible into these bonds. Both the notes and the bonds are 6 per cent. issues. The bonds are guaranteed by the Missouri Pacific. This Missouri Pacific issue was soon followed by another convertible note issue. The Hudson Companies, the construction company which is building the Hudson & Manhattan Railroad, the first of whose tunnels under the Hudson river was opened on Tuesday of this week, have recently put out $15,000,000 two-year "secured" 6 per cent. notes with first mortgage bonds of the Hudson & Manhattan Railroad as collateral. The notes are convertible at maturity into these bonds at par. There is a further interesting feature of this collateral convertible note issue secured by bonds. The first mortgage bonds of the Hudson & Manhattan are themselves convertible at par after 1911 into common stock of the Hudson & Manhattan at $110 a share. Thus we here have notes convertible into bonds which are themselves convertible into stock. Other methods which seem to be the favorites at the moment for

railroads which are looking for new funds are the issue of mortgage bonds on some part of a big system which either is not bonded at all or has a low bond issue, or the issue of equipment notes secured directly on equipment and either sold outright or used as collateral for loans. The Baltimore & Ohio, for instance, last week sold $6,000,000 one-year 5 per cent. notes secured by $8,000,000 Pittsburgh, Lake Erie & West Virginia refunding bonds. The Union Pacific is reported to be planning to issue mortgage bonds on the 1,650 miles of its lines which were on June 30, 1907, free of lien. The sale in January of $30,000,000 New York Central Lines equipment notes is the largest piece of recent railroad financing. The Illinois Central may issue the same amount of equipment notes on some $40,000,000 worth of unmortgaged equipment, but these are likely to be used as collateral for borrowings instead of being sold.

THE COMPLEXITIES OF RAILROAD PENALTY.

In these parlous and somewhat topsy-turvy times, when the big stick of the federal executive and the rods of state legislation are falling upon the backs of the just and the unjust, it is interesting and in the end may be instructive to study the variations of railroad penalty—past, present and proposed—and also its diversity of victims. We are seeing some unprecedented anti-railroad forces in more or less active play. Some primal laws of political economy, recognized alike in the academic classroom and in practical experience, are to be suspended if authority can do it. There is to be one law for the corporation, another for its working units, with the stockholder, whether innocent on the one hand or, in the legal phrase, guilty of "contributory negligence" on the other hand, shouldering the ultimate burden. Under such conditions the incidence and distribution of penalties, their justice or injustice, and the complications that attend them become, as subjects for analysis, something better than a merely intellectual exercise.

Starting with the railroad corporation itself, how vast its variations in history! One corporation projects itself on the screen as speculative from its first inception and speculative in high degree. Or, from the start, it may have been conservative or well-nigh so. Or, again, it may have risen from the low plane of speculation to the upper plane of honesty, or reversed the process and descended. It may have been solidified by a reorganization or it may have been inflated. In the swift progress of railroad consolidation in this country and others many of these changes have been lost sight of. Investors, as well as non-investors, are apt to be forgetful. The great railroad system of to-day is outwardly an entity, but historically made up of units the original status of which has, generally speaking, disappeared in the march of railroad events. Some picturesque features are still held in memory, but only by the older generation. One not far beyond the bounds of middle life may recall the Credit Mobilier in Union Pacific or the Gould "Chapters of Erie" as crystallized in the narrative of Charles Francis Adams, or the 80 per cent. stock dividend of New York Central. But most of the details of railroad history, and nearly all the details of consolidation, have for the ordinary observer and the ordinary investor sunk below the horizon, save as they appear in the form of a long lease of component or subsidiary lines or some special guarantee of bonds or the mortgage quality of bonds as applied to parts of a system. The big railroad of to-day is a composite, broadly speaking.

When one comes then to the application of penalty to past railroad misconduct, whether that penalty is to be exercised under actual law or merely used as a moral force for the regulation of wages, one may well inquire what are the scope and limitations of such a policy. How far does it go back, of what class of offences is it to take moral or statutory jurisdiction, are its methods to be personal or corporative? Will it reach back to the scandals of the Credit Mobilier, or will it stop with Harriman? Will it "go for" the speculative railroad systems alone, or will it include those which have been relatively sane and the investment field of the trustee and the widow? Will it strike at the work of the high financiers who a few years ago, in the case of certain big western lines, financed their stock into bonds, sold out and retained control by a holding company? or will it merely consider present conditions of earning power? Will it, as a test of threatened wage reduction, apply the hydrometer to each railroad corporation and make that the test of equitable earning power?

So much for the corporation considered as the target of penalty. Turning next to the stockholder, we find him in as many diverse situations of responsibility as the railroad system. But excluding him as the mere speculator who takes his risk and is not entitled to much mercy, and treating him as the honest investor, he offers us still many investing personalities. He may in a few cases be the now white-haired original investor in a new and successful railroad project, but in that character, as regards steam railroad enterprise, he is not now common. His railroad shares, selling in the market at the time of his death on a four or five per cent. basis, have passed to others. It may be in fee to direct heirs. It may be to trustees anthorized to make up the trust from funds of the estate on a market valuation. It may be that at the same valuation the shares have been sold. But whether held or sold, two points are to be emphasized for the conservative investor in the dividend-paying railroad stock. First, that it has been bought or held on a low interest rate return, and, secondly, that it has been acquired or held under the reasonable assumption that old policies of the government, state or national, would protect it, and that radical policies would not assail it. Such an innocent investor had a right to assume, did assume, and the precedents of federal policy gave him the right to assume, that natural law rather than artificial checks would adjust wages just as it would affect earnings or dividends, that there would not be one rule for earnings and profits and another for wages, and that hard times would distribute its burden on both parties and not load them upon one on the basis of some vague and indeterminate official interpretation of railroad "misconduct." Saying nothing of the federal proposition, as a matter of public policy, does it not invade a basic right of property?

One can push the analysis of the confusing situation still further. It can be asked, for example, how far railroad "misconduct" bears upon the rights of bondholders or holders of leased line stocks, and whether they, too, may not, under certain conditions, come under the federal theory of direct or indirect penalty in the form of fiscal loss? Then there are the street railway corporations, few of them interstate, to be sure, but liable to be the victims of reflex action from the federal capitol playing upon state railroad commissions and legislatures. But this is a look ahead, though not necessarily a far look. For the moment the new executive dicta striking into the vast complexity of corporate relations to wages and into primal rights of property are big enough when limited to steam railroads alone. Time will show whether or not they are more serious and abiding than the political gestures that end with a presidential voting day.

WHAT ARE WE GOING TO DO ABOUT ACCIDENTS?

We print this week three contributions commenting on Mr. Boardman's open letter to newspaper editors, printed in the *Railroad Gazette*, January 31, under the caption "What Are We Going to do About Railroad Accidents?" One of our contributors is Mr. Cease, editor of the *Railroad Trainman*, who says that there has as yet been no evidence submitted to prove that the railroad (labor) organizations have interfered with the enforcement of discipline, that they have advised their employers, or in an arbitrary or unfair manner have intimated to them who should be employed.

Well, let us see. Discipline looks forward as well as backward, and its use in preventing things from happening is a great deal more important than its function of punishing people for things that have happened already. No further instance of this principle is necessary than consideration of what happens to a private in the army who talks back to the sergeant, or of what is done with a sentry who falls asleep at his post, quite regardless of the actual effect which either of these infractions of discipline may have. Now, what is the procedure when a railroad officer tries to enforce discipline before trouble comes, instead of after? In building up or in maintaining any organization, the first question is that of the personnel. How is the personnel of appointments in railroad work determined?

The relations between the railroad and its employees are commonly set forth in the form of a contract for which the superintendent, locally, and his employees, locally, have no direct responsibility. This contract makes the superintendent presiding officer of the court of first instance, from which there are unlimited appeals as to fact, interpretation of agreement, etc. This applies to discipline, rates of pay, appointments, or promotions. At such investigation board, the trainman or the employee investigated is represented by a man trained in such work, whose business it is to make as much capital and gain as much as possible for his clients. It is his object to make exceptions, to pick flaws, and otherwise to hinder any prompt and efficient measures to remedy a condition by

disciplining the man at fault. When a run becomes vacant the fact is advertised and, other things being equal, seniority determines the right to that position. By "other things being equal" is meant not the judgment of the superintendent as to the qualifications of the man, but tangible facts against his records which can be proved and substantiated. This means that the opinion of the superintendent as to the ability or efficiency of the man in question counts for nothing. He is merely there in a judicial capacity, with power to keep out men who have already made mistakes that prove their lack of qualification for the position. He becomes, therefore, a judge of the past, and his authority to provide against trouble in the future is greatly restricted.

The superintendent has not the authority to enforce discipline which, for instance, is considered absolutely necessary for the commissioner of police in New York. The investigations become wrangles, compromises, deals, in which the employee feels that he is being attacked by the railroad and defended by his organization. Disregarding for the present the question of punishment for infractions of discipline which have made trouble, it is clear enough that this arrangement ties the hands of the superintendent desiring to place his personnel on a basis of efficiency only, and requires him to base his action on an entirely different set of facts, the principal one being that trouble with the unions is costly and has got to be avoided whenever it can be. We have a case in mind where there were thirteen brakemen in line for promotion on the basis of seniority. Numbers 5 and 7 (according to the time of service) were two experienced conductors from other roads who were first-class railroad men and entirely competent to take charge of a train as conductor. On the other hand, numbers 1, 2, 3, 4 and 6 were all young men who had been in the service of the road less than two years and who were unable to pass an examination under which they were required to take a time card and figure themselves over the road with an assumed extra train at a speed of 30 miles an hour; a very simple proposition for an experienced trainman. Numbers 5 and 7, the two experienced men who had come from the outside, were promoted, but the Brotherhood of Railroad Trainmen appealed from the decision of the superintendent, claiming that the rights of its men were being ignored, since the men promoted were members of the Order of Railway Conductors. The case was appealed to the general manager, who felt obliged, in the interests of harmony, although against his own judgment, to reverse the action of the superintendent, sending Numbers 5 and 7 back on the list, and promoting Numbers 1 and 2—an action exactly opposed to the kind of discipline that looks ahead and prevents accidents.

Here is another instance. As is well known, the Order of Railroad Telegraphers does not permit the members of the order to teach students; consequently agents or operators who are members of this organization openly refuse to take orders from superintendents to give any instructions whatever to young men to learn their business. If we revert again to the army for an instance, we find this kind of attitude described by the term "insubordination," and punished promptly and severely. What does the editor of the *Railroad Trainman* suppose would happen to a group of corporals in the army who refused to instruct their squads when ordered to do so by the lieutenant? Yet are we not right in assuming that if a railroad telegrapher should be discharged for a similar refusal, his organization would sustain the insubordination to the last ditch, even to the point of a strike? We have another case in mind, somewhat parallel, occurring where two railroads were consolidated. The employees of one road were dissatisfied with the positions of their names as placed on the seniority list by the superintendent, and they appealed to the general superintendent and then to the general manager. The question was not one which affected the company very directly or tangibly, and so the general manager, fearing a strike, reversed the action of the superintendent. Of course the employees of the other part of the consolidation did not like this decision, and they appealed to the general manager to reverse himself, which he declined to do. The four train service organizations, represented by their grand chief officers, then appealed to the president of the road and obtained a reversal of the decision. At time of writing, we understand that the first set of employees is now working up another appeal, and it is expected that the general manager will again be called upon to reverse himself and come back to his first decision. Whether he does or does not do so, it is very clear that the position of the superintendent, from whom the case was originally taken, is humiliating, and that the situation is certainly not conducive to good discipline. Under such circumstances as these a superintendent naturally hesitates to discharge a man who is a member of a strong organization unless he has a clear, tangible case that he can prove against him. The fact that to the best of his knowledge and belief the man is untrustworthy, is not enough. His position is closely comparable to that in which the chief of a track gang would find himself if he were allowed to remove broken rails but not cracked ones.

On a large railroad, with 10 divisions, for example, there are at least 100 chairmen of division organizations, and some four or five general chairmen. The latter, as a rule, are paid by the year to look after the interests of the members of their organizations and are not engaged in actual railroad work. The 100 division committeemen are engaged in railroad work, but their principal interest lies in looking after their associates. It is the practice for every member of the organization who is disciplined either by dismissal or suspension to take up his case in writing with the committee, and probably 98 per cent. of all the applied cases of discipline are brought to the attention of the division officers by the local committees. If there is any loop hole in the investigation, or if there are any differences in the testimony, a pretext for an excuse is thereby furnished, and if no possible excuse can be found, the plea of sympathy is then set up for the delinquent. The members of the committee are all selected for their special power in pleading; they are what are known as good railroad lawyers. If the division people fail with the local officers, the general chairmen, who have no other occupation, will take the question up with the higher officials.

It must be said in all fairness that there are times when these committees do secure evidence which was not brought out when the discipline was first applied. There have been numerous cases where they have seen justice done to their associates, but it is impossible to confine committees to the pursuit of entire justice. They take up the plaints of the just and the unjust alike, and the superintendent knows well that enforcing discipline means a struggle, while the young employee who has recently entered the service is very much impressed with the knowledge that his labor organization has in its membership thousands of men, with a million or three million dollars in the treasury to defend its members when they get into trouble. It would be strange indeed if he did not feel that his union came first and his railroad second. It would be untrue to human nature if he did not possess the conviction that a discipline case was a sort of feud between two strong clans, one composed of the officers of the road and the other of the members of his brotherhood, and that his clan duty was clear—and the worst of it is that the man most affected by this is the superintendent, the officer on the ground, who knows the facts and has more power than anybody else to make travel safe or unsafe. Of course he hesitates to enforce necessary discipline when he has reason to fear that his decision will be overruled, and that continued appeals will lead his superiors to regard him as unfit to handle labor.

The point is, that discipline to prevent accidents should look forward and not backward. While the labor agreements do not prevent a superintendent to dismiss a man for the harm he has done, they make it exceedingly difficult to dismiss him for the harm he is likely to do.

Train Accidents in January.[1]

Our record of train accidents occurring on the railroads of the United States in January includes seven collisions and 10 derailments and one boiler explosion, 18 accidents in all. This record is not published in full except in the cases of the few accidents which are especially prominent—in the present instance three collisions and one derailment. The record of "ordinary" accidents—which term includes, for our present purpose, only those which result in fatal injury to a passenger or an employee or which are of special interest to operating officers—is given at the end in the shape of a one-line item for each accident, showing date, location, class and

[1]Abbreviations and marks used in Accident List:

rc.....Rear collision.
bc.....Butting collision.
xc.....Other collisions; as at crossings or in yards. Where only one train is mentioned, it is usually a case of a train running into a standing car or cars, or a collision due to a train breaking in two on a descending grade.
b.....Broken.
d.....Defective.
dr.....Defect of roadway.
eq.....Defect in car or engine.
n.....Negligence.
unf.....Unforeseen obstruction.
unx.....Unexplained.
derail.....Open derailing switch (negligence of engineman or signalman).
ms.....Misplaced switch.
acc. obst..Accidental obstruction.
malice....Malicious obstruction of track or misplacement of switch.
boiler.....Explosion of boiler of locomotive on road.
fire.....Cars burned while running.
Pass.....Passenger train.
Ft.....Freight train (includes empty engines, work trains, etc.).
*Wreck wholly or partly destroyed by fire.
†One or more passengers killed.

number of deaths and injuries. The items of which details are given are indicated in the tabular statement by the use of italics. This record is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to send a letter of inquiry to the railroad manager.

The collision at Vinegar Bend was reported in the newspapers as having involved a passenger train, but it did not; it was on a logging road, and we are informed that each of the trains consisted of an engine and some empty cars; one was a log train and the other a work train. The log train had been brought to a stop before the collision occurred. Neither was it true that a trestle bridge was demolished. Four employees were killed, nevertheless.

The collision at Crockett, Va., occurred at 2.25 a.m. at a water tank, a westbound freight train, with two engines, which was standing there, being run into by the eastbound Chattanooga-Washington Express. Two engines and the mail and express car were damaged, and two postal clerks and one passenger were slightly injured. The collision was due to the freight train being on the time of the passenger train on the main track without proper protection. The passenger train was running 4 hours and 15 minutes late, exactly as had been stated in the order. Both of the enginemen on the freight were young, and they offer no rational explanation. The telegraph block system which had been in service on this district about three months had just been discontinued by reason of a decrease in business and in order to reduce expenses.

The collision at Cameron, N. C., is reported as having been due to an error made by a telegraph operator in copying a train order. One of the trains was to wait at Southern Pines until 12.15 a.m., but the order was delivered to the other train reading 12.50 a.m.

The cause of the derailment near Hiram, Ga., on the 7th was not discovered. The second section of the southbound Florida Special was derailed at a trestle bridge, the engine being overturned just as it had passed over the bridge. Four of the cars fell 20 ft. to the ravine below. One of the car bodies was broken in two, and in this car most of the serious injuries occurred. The engineman, a traveling engineer, a fireman and one passenger were killed and 62 passengers and 13 employees and five Pullman employees were injured. At the time of derailment the train was running about 40 miles an hour. Close investigation following the accident failed to develop any cause for it. The track and equipment were in good order.

Train Accidents in the United States in January, 1908.

Collisions.

Date	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	No. persons reported Inj'd.
5.	C., B. & Q.—C. Gt. W.	E. Dubuque.	xc.	P. & Ft.	2	1
10.	*Ala. & Miss.*	Vinegar Bend.	bc.	Ft. & Ft.	4	5
11.	*Norfolk & Western*	Crockett.	bc.	P. & Ft.	0	3
11.	Buff. & Susp.	B., R. & P. Jun.	bc.	Ft. & Ft.	1	1
14.	Chic., R. I. & Pac.	Caldwell.	bc.	Ft. & Ft.	1	0
18.	*Seaboard Air Line*	Cameron.	xc.	P. & Ft.	2	20
22.	Denver & Rio Grande	Huerfano.	bc.	Ft. & Ft.	1	2
29.	Boston & Albany	Cheshire.	xc.	P. & Ft.	1	0

Derailments.

Date.	Road.	Place.	Kind of train.	Cause of derlmt.	No. persons reported Kil'd.	No. persons reported Inj'd.
2.	Boston & Albany	Westboro.	Pass.	b. wheel.	0	4
6.	Great Northern	Wolf Creek.	Ft.	b. flange.	2	0
†7.	*Southern*	Hiram, Ga.	Pass.	unx.	4	80
†9.	Southern Pacific	Rucker, Cal.	Pass.	unx.	2	0
13.	Illinois Central	Holly Springs.	Pass.	cow.	1	3
19.	Southern	Corydon.	Ft.	unx.	3	2
19.	Central of Ga.	Macon.	Ft.	ms.	1	0
20.	A., Birm. & A.	Tyrone.	Ft.	acc. obst.	2	5
20.	Louisville & Nashville.	Frankfort.	Pass.	unx.	0	3
21.	A., T. & S. Fe	Quenemo.	Pass.	unx.	0	6

Other Accidents.

13.	Erie	Rutherford.	Ft.	boiler.	1	3

In the reports of the electric car accidents published in the newspapers in January we find no account of any fatality.

Pressed Steel Car Company.

The gross sales of the Pressed Steel Car Company during the year ended December 31, 1907, were $36,400,000, the largest in the company's history, though little larger than in 1906. Operating expenses, including "liberal charges on account of renewals and up-keep of plant and machinery," increased more than gross sales, so that the net profits, not including dividends from subsidiary companies, were $2,900,000, against $3,100,000 in 1906. No dividends were paid by subsidiary companies last year, as all of them needed their surplus earnings to add to working capital. In 1906, on the other hand, the Pressed Steel Car Company received a dividend of $225,000 from the Pennsylvania Car Wheel Company. For depreciation and renewals there was $365,000 set aside in 1907 and $350,000 in 1906. The 7 per cent. dividend on the $12,500,000 preferred stock which has been continuous through the nine years since the organization of the company, was paid, leaving a surplus of $1,668,000, which is equal to 13.3 per cent. on the $12,500,000 common stock. The surplus earned in 1906 was $2,157,000.

The percentage of profit realized last year was lower than in some previous years, for two main reasons. During March, work at both the Allegheny and McKees Rocks plants was stopped for several days, owing to the greatest flood since 1832 in the Ohio river. Several weeks passed before output was again normal. Most of the machines were badly damaged and some had to be entirely rebuilt, all of which expense was charged to operating cost. The other cause was higher wages and lower efficiency of labor during the first half of the year. As a result of the great demand for labor in the Pittsburgh district the company had to choose new men out of the newer foreign population, who represented a lower average standard of efficiency than those who formerly came to the district. This had a distinct effect in lowering profits. In this connection, President Hoffstot remarks that the slowing down of business which came at the end of the year, although it decreases profits, has some redeeming features, for it makes the supply of labor larger than the demand and thus makes it possible both to choose better men and to get better work out of the whole force. During the last six months the company has been able without any lowering of efficiency, substantially to reduce labor costs, so that cars built in the latter part of the year cost less to build than those built previous to the decrease of business, when the demand for labor equaled or exceeded the supply.

Another favorable feature is that when work is being done at low pressure, time and attention can be devoted to economies and development along new lines. The company's policy in regard to prices is not to artificially maintain prices which under existing business conditions would be unsubstantial and unreal, but to reduce prices to a point which will create and restore a normal demand. Mr. Hoffstot believes that the policy of maintaining the same prices during periods of depression as in prosperous times retards rather than helps the speedy return of normal conditions.

Additions and betterments costing $268,000 were made during the year, over two-thirds of which went for a new water purifying system, additions to the planing mill and wooden car shops, and new machinery for the passenger car equipment of the McKees Rocks plant. The rest of the expenditure was used in the Allegheny plant for additional power. Here also a water purifying plant is to be put in if the one at McKees Rocks, which is not yet finished, is successful.

The Pennsylvania Car Wheel Company earned less than in former years; what it did earn was added to working capital. Its smaller earnings were due to an increase in the cost of pig iron and coke greater than in the price received for car wheels. No statement of earnings is given for any of the subsidiary companies, including the Canada Car Company and the Western Steel Car & Foundry Company. In 1905, the last year in which figures for this last company were reported, its gross sales were $7,563,194. In that year a 6 per cent. dividend was paid.

Generally speaking, the report, like that of most industrial companies is inadequate. The only figures shown, except those included in the condensed balance sheet filling one page, are the two of gross sales and net profits. Publicity is one of the most important tendencies of the times and is becoming more and more important. There are, of course, certain facts in regard to the operation of a manufacturing company whose business is sharply competitive which ought in justice to it never to be shown, but there is a golden mean possible between the present meager information given by this and other similar companies, and injurious publicity.

The steel passenger car department is just finishing an order for 85 steel passenger train cars for the Pennsylvania Railroad. Although the all-steel passenger car is as yet a pioneer and cannot be relied on as a fixed source of revenue, the company believes that these cars will before long be standard in this country. Mr. Hoffstot takes occasion at this point to decry the hostile public sentiment toward railroads. A changed attitude toward railroad securities, he believes, would make it possible for all railroads to offer the best equipment and the greatest safety and thus speedily result in replacing wooden passenger cars with fireproof steel cars. This department of the company has been so arranged, however, that semi-fireproof and wooden passenger cars can be turned out when steel passenger cars do not require its full capacity.

The following table gives for each of the nine years of the company's life the gross sales, net profits including dividends from subsidiary companies, dividend payments and surplus for the year:

	Gross sales.	Net profits.	Dividends.	Year's surplus
1907	$36,443,304	$2,907,920	$875,000	$1,667,920
1906	36,138,586	3,881,884	875,000	2,158,884
1905	19,357,826	1,106,901	875,000	56,901
1904	4,498,268	707,111*	1,250,000	2,037,111†
1903	26,601,249	2,768,897	1,500,000	1,008,897
1902	33,883,519	4,578,114	1,375,000	2,903,114
1901	23,032,491	1,927,925	1,375,000	409,290
1900	22,540,115	2,075,181	1,625,000	1,200,181
1899	14,108,212	2,237,000	875,000	612,000

*Loss. †Deficit.

The uptown tunnel of the Hudson & Manhattan Railroad was opened last Tuesday afternoon, when a train carrying officers of the companies concerned, the Governors of New York and New Jersey, and other distinguished men, was run from Nineteenth street

and Sixth avenue, New York, to Hoboken, N. J. At midnight of the same day the line was opened to the public. For the present, cars will be operated on three minutes headway during the rush hours, the time for the three miles now in operation being 12 minutes, including five stops. At other times, they will run on five minutes headway. These twin tubes are the first of the several tunnels under the Hudson river to be opened for service. This line also is the oldest of the projects, its history going back 30 years. Its checkered career was summed up in our issue of last week, in the description of the completed tunnel. As mentioned in that article, the southern tubes of the company are nearly finished and will be opened in the summer. Farther north are the four-track Pennsylvania tunnels, which will be ready still later. The line just opened will have no immediate result in relieving existing lines of the burden of taking care of the enormous daily movement of people within New York City, as the great part of this traffic is between the upper part of the city and the southern part of the island. However, when the connecting line is built from Sixth avenue, under Ninth street to a connection with the Interborough Rapid Transit subway near Astor place, it is to be expected that many people living between Fourteenth and Thirty-third streets, west of Fifth avenue, will take this route in going up and down town and so relieve the older subway of some of the traffic originating between Astor place and Forty-second street. The great value of the new tunnel lies, of course, in making the journey from Hoboken and Jersey City to Manhattan quicker and surer. The extent of this traffic was suggested last week in the article mentioned. It is now being taken care of by ferries, which are subject to delays by fog and storm, and, during most of the winter, by floating ice. The completion of the various Hudson river tunnels will therefore result in extending westward the area available for residence of people who come to business daily in New York.

NEW PUBLICATIONS.

Principles of Reinforced Concrete Construction. By F. E. Turneaure and E. R. Mauer. New York: John Wiley & Sons. 317 pages, 6 in. x 9 in.; 130 illustrations. Price, cloth, $3.00.

To quote from the preface, "the authors have endeavored to cover, in a systematic manner, those principles of mechanics underlying the design of reinforced concrete, to present the results of all available tests that may aid in establishing coefficients and working stresses, and to give such illustrative material from actual designs as may be needed to make clear the principles involved." The book opens with a brief historical review of the use of reinforced concrete and then takes up its properties, dealing first with the materials and methods of mixing and the strength of the whole after setting. In dealing with the material the standard assertion is made that "Portland cement only should be used." It is curious that in spite of the unanimity of opinion upon this point among all authorities of the subject, none of them state the reason why, or give any data showing the difference of action between Portland and natural cement when used in reinforced construction.

In discussing the physical properties of concrete, the authors go very elaborately and thoroughly into the elasticity, and show that, contrary to preconceived ideas, there is no change in the characteristics of concrete in this respect when it is reinforced, and that it does really crack when stretched beyond its elastic limit, and that it is the steel reinforcement that holds it together, preventing the cracks from becoming visible and the concrete from failing. Great emphasis is, therefore, placed not only upon the extensibility of the concrete but its adhesiveness to the steel.

In the third chapter there is a full theoretical discussion of the method of resisting the stresses imposed, including the general stress distribution in a homogeneous beam, the common theory of beams, the formulas for working and ultimate loads and the parabolic formulas. This chapter also includes a mathematical discussion of double reinforcing, flexure and the strength of columns.

This is followed by a presentation of the results of many important tests, which are analyzed and correlated, with reference to the theoretical principles that have already been set forth. Then comes a consideration of working stresses and economical proportions, with a collection of such formulas and diagrams as may be needed for general use.

The final chapters deal with building construction, arches, retaining walls, dams and miscellaneous structures, all of which are illustrated by examples taken from practice and then analyzed mathematically in accordance with the principles previously enumerated.

Proceedings of the Traveling Engineers' Association, 1907. 340 pages; 6 in. x 9 in.; 10 illustrations.

The association meeting was held at Chicago, in September, 1907. The subjects presented were all connected with the operation of the locomotive, as follows: The Best Means of Locating the Fault of a Poor Steaming Engine without Removing the Draft Appliances; Advantages of Hot Water Washing and Filling for Boilers; Best Methods of Eliminating the Smoke Nuisance on Soft Coal Burning Engines; Air-Brake Requirements to Effect a Proper Train Control; Superheated Steam and the Best Methods of Getting Good Results; Waste of Energy in Railroad Operation; Lubrication of Cylinders Using Saturated and Superheated Steam; Reduction of Coal Consumption and Increase of Locomotive Efficiency; Relation of the Road Foreman to Indifferent Enginemen; Advantages of the Automatic Stoker and the Performance of the Automatic Stoker on the Iowa Central.

The report on the mechanical stoker is interesting in that it states, in outline, the work that has been done by the Monarch and Hayden stokers. Satisfactory results have apparently been obtained with both, so far as maintenance of steam pressure is concerned. In the matter of economy of coal consumption, some definite information is given, and, in the report of the work done on the Iowa Central a marked saving is shown by the use of the stoker. Taken on the basis of the coal consumed per 1,000 ton-miles, the schedule shows that for runs without the stoker there was a marked increase in the amount of coal consumed. For example, on engines with the same cylinder and firebox dimensions, the coal consumed was 181 lbs. and 206 lbs. per 1,000 ton-miles without the stoker and 143.7 lbs. and 166.6 lbs. with the stoker; an average saving of nearly 20 per cent. The engines used in the two tests had 20-in. by 26-in. and 22-in. by 26-in. cylinders respectively. It was probably on the basis of such a showing as this that the report concluded by expressing the opinion that "the stoker has come to stay, as it can do all that is claimed for it if the care is taken of it that it is entitled to."

Another paper of value, the subject of which has been discussed with all the variations imaginable, is The Waste of Energy in Railroad Operation. This time the discussion is confined to the locomotive, and there is a staggering array of causes of waste, divided under the headings of coal, heat, steam, power, time at roundhouse and time on the road. The paper concludes with the statement that "in view of the many ways in which energy may be wasted it may seem surprising that there is really any left." Then it must be borne in mind that "while one or two of them alone would make a small item, nevertheless a man must be alert and watchful to keep them down to a minimum for waste is a prolific creature and unless watched and controlled increases and multiplies to such proportions as to ruin good men's careers and wreck good roads."

In the other papers listed the subjects were well handled in a practical manner, and were up to the standards of the previous proceedings of the association.

Machine Shop Work. By Frederick W. Turner, Instructor in Machine Shop Work, Mechanic Arts High School, Boston, Mass. Chicago: American School of Correspondence. 190 pages; 6½ x 9½ in.; 248 illustrations. Price, cloth, $1.50.

This book contains part of the series of papers used by the publishers in their correspondence course of machine shop instruction. These papers have already appeared, for the most part, in Vol. III. relating to the Foundry, Forge and Machine Shop of the set on Modern Engineering Practice that was issued two or three years ago. This statement holds for the whole book with the exception of the chapter on the Milling Machine, which has been re-written and extended for the present volume. Of course it cannot be expected that the whole science of machine shop practice can be taught or even touched upon extensively within the limits of a book of the size of this one, but it can serve, as indicated in its preface, as a practical working guide for those who are employed in shops. Naturally, where such brevity is demanded, much has to be taken for granted, and the reader is assumed to know many things that can only be learned by actual experience. This appears from time to time by reference to certain things of whose use and construction there is no explanation, and in this it frequently falls just short of giving very specific instructions. It is, however, valuable in its suggestiveness, and for the reasons that are given for the performance of certain operations in a certain way, and the use of certain methods. The book is concise in its language and is made to cover the ordinary ranges of work with hand tools, the lathe, planer, drill, milling and grinding machines; and, while it does not attempt to enter upon a description of the construction of these tools, it does give a very clear idea of the class of work that may be expected to be done on each.

The Slide Rule. By Charles N. Pickworth. London and Manchester: Emmott & Co. New York: D. Van Nostrand Co. 105 pages; 7 in. x 5¾ in.; 24 illustrations. Price, cloth, $1.00. Tenth edition.

It is characteristic of the slide rule that it is used either very persistently and constantly or not at all. The engineer who has once acquired the slide rule habit, uses it for any and all varieties of calculations, fully aware of its inaccuracies but knowing that these inaccuracies lie well within the limits of permissible error. The probability is that many would use the instrument who do not now do so were the principles of its construction and manipulation understood. The book under consideration is intended to furnish just that information and will do so if it is carefully studied. Of course the

best way to acquire the needed information and skill would be to read the book with a slide rule in hand.

It starts in with the simplest of propositions, the adding together of two numbers of a single digit each, and then shows how identically the same thing is done when the two logarithms of the same numbers are added, the result being a multiplication of the two original numbers. In the same manner the simple act of a subtraction becomes a division. Nothing is taken for granted and each step in the process is explained with painstaking elaboration, leaving nothing to conjecture, and nothing for even the most stupid to desire. Having explained in the fullest detail this simple principle of construction and operation, the author goes on to show the methods to be followed in solving certain definite problems, such as proportion, multiplication, division, combined multiplication and division, involution and evolution, and the solution of examples in technical computation, such as the weights of metals, falling bodies, centrifugal force, steam engine problems, screw cutting, strength of shafting, moments of inertia and a mass of trigonometrical applications.

The book closes with a description of the log-log slide rule and other special rules that have been designed with a particular object in view. Taken all in all, the book is a complete, and therefore a valuable, guide to the use of the common slide rule, and withal it is so simply written and the explanations are so clear and comprehensive that it cannot fail to be understood by even the most indifferent of students; and, if it can but be placed in the hands of those who do not use the instrument, it cannot fail to lead many of them to adopt it as a time and labor saver for all ordinary and many extraordinary calculations.

Report of the Proceedings of the Fifteenth Annual Convention of the International Railroad Master Blacksmiths' Association, 1907. 244 pages; 6 in. x 9 in.; 11 illustrations.

The convention was held at Montreal in August, 1907, and some of the papers have already been reviewed in the *Railroad Gazette*. The subjects presented and discussed were: Tools and Formers for Bulldozers and Steam Hammers; Forging Machine and Bulldozer Work; Discipline and Classification of Work; Flue Welding; Case Hardening; Best Fuel to Use in Smith Shop; Piece Work; Frame Making and Thermit. In addition to these topics the proceedings contain a number of others reprinted from previous proceedings. These are: The Clean Shop; Relative Importance of the Blacksmith Shop to the Cost of Rolling Stock Maintenance; The Foreman Blacksmith; Case Hardening; Uniform Methods; Treatment of Tool Steel; Heating for Hardening and Annealing; Annealing; Track Tools; Scrap Materials; Iron vs. Steel and Shop Discipline.

Subject Matter Index of Mining, Mechanical and Metallurgical Literature for the Year 1902. Edited by M. Walton Brown, Secretary of the North of England Institute of Mining and Mechanical Engineers. Newcastle-upon-Tyne, England. Published by the Institute. 180 pages; 6 x 9¾ in. Price, paper, 42 shillings.

This is an index, for 1902, of articles which appeared in 993 journals, proceedings of societies, government reports, etc. A large number of separate books are also indexed. The publications selected are from countries all over the world. The index is arranged according to subjects, each being minutely subdivided. They include: Geology, mining technology, metallurgy, machinery, navigation, railroads, legislation, etc. An index of authors is included.

CONTRIBUTIONS

What Are We Going to Do About Railroad Accidents?

Cleveland, Ohio, Feb. 5, 1908.

To the Editor of the Railroad Gazette:

Your open letter to newspaper editors, under date of Jan. 30, 1908, captioned, "What Are We Going to do About Railroad Accidents?" while interesting and timely, lacks proof to substantiate the statement made by you that holds the railroad employer responsible for railroad accidents, because he does not enforce discipline and holds the employee responsible because he, through his organizations, will not permit of the enforcement of discipline.

In answer to the inquiry propounded by the *Evening Post*, New York, which had the question of railroad accidents under discussion, "What Are You Going to Do About It," you answered for the railroad managers as follows: "We are doing more than ever before; are making progress, but cannot be successful until we are allowed to control our employees." In the employment and discharge of enginemen and train crews, the trade unions have rather more authority than the employers, and except perhaps on the Reading and the Chicago, Burlington & Quincy, which have paid millions for the privilege, dangerous men cannot always be weeded out. Nevertheless, many railroad officers do less than their full duty in organization and vigilance, and are legally and morally guilty of criminal negligence. The force of public opinion, which the newspapers aim to express and often influence, together with the enforcement of the present laws, is probably the only hope for a better condition.

The statement made by you is simply a repetition of others that have been made from time to time but, as yet, there has been no evidence submitted to prove that the railroad organizations have interfered with the enforcement of discipline, that they have advised their employers, or in any arbitrary or unfair manner intimated to them who should be employed.

The enforcement of discipline is entirely in the hands of the railroad employer. He makes his rules and he can and does enforce them. The organizations have not by threat, intimation of trouble, or by unfair or arbitrary performance, insisted on the retention of any employee who justly has been disciplined. The railroads employ whom they please. In order to protect themselves against inexperienced employees, the railroad organizations will not accept an employee to membership until he has served an apprenticeship of from six months to one year.

The railroad organizations naturally prefer the employment of members of their organizations, the first reason being that there is assurance that the employee knows something of the duties of the service. The "student" does not and until he does he is a dangerous fellow servant, and consequently not as desirable a fellow employee as one who is experienced.

When you say "In the employment and discharge of enginemen and train crews, the trade unions have rather more authority than the employers," you are in error.

We will welcome a statement from any railroad manager, giving specific instances that will prove the often repeated charges that railroad organizations interfere with discipline, the employment or dismissal for cause of men, or that they have prevented the safe and proper operation of any railroad property.

This statement has been made in *The Railroad Trainman*. Courteous treatment has been assured any operating officer who will come forward with his bill of particulars, and *The Railroad Trainman* will give him, or as many of him as there may be, full opportunity to state his case and show wherein the Railway Associations have hampered him.

There has never been anything offered to back up the statements made, and I request for the Brotherhood of Railroad Trainmen that the *Railroad Gazette* make request that every railroad operating officer come forward with a bill of particulars setting forth in clear, unmistakable language, just when and how he has been prevented from safely operating his property or enforcing proper discipline.

So far as the Brotherhood of Railroad Trainmen is concerned, and I feel that the other railroad organizations will voice the statement, it welcomes anything of the kind and is anxious for the opportunity to meet every question offered, with your permission, in the *Railroad Gazette*, taking it for neutral ground, and let your readers judge the questions for themselves.

Let us get at the bottom of these assertions. Let us have a clearing up of the statements that have been made concerning the interference of the railroad organizations with the right of the railroad managers safely to operate their properties.

It might be just as well to say in this connection that the conductors and trainmen have had a splendid organization on the Burlington for many years, and that the Reading is very well organized. Your comparisons, therefore, are not well selected.

Inasmuch as you have taken up this matter and made answer of your own, for the railroad managers, in all fairness we ask you to kindly continue the discussion and let us get the facts. Let us tell the public the truth not only about the "interference of the railroad organizations," but while we are at it, it might be well to introduce other questions that affect the safety and efficient operation of railroad properties.

I trust that the *Railroad Gazette* will throw open its columns for signed articles, showing just how far this great abuse has been carried.

D. L. Cease,
Editor *The Railroad Trainman*.

New York, Feb. 15, 1908.

To the Editor of the Railroad Gazette:

I have read with interest the proof of Mr. Cease's letter, and could give him all the specific instances he wished, if it were not for the effect which this might have on our present friendly relations with our employees. But I can cite the following actual cases, omitting places and dates, which have come under my personal observation:

(1) A locomotive engineer was discharged for running by a disc signal at red at an approach to a drawbridge, running into the open draw, the engine and two or three of the cars going into the river, the engineer and fireman saving themselves by swimming. Investigation disclosed that neither engineer nor fireman could have been looking for signal as brakeman back on box car in middle of freight train saw signal at red, and bystanders also saw signal at red as train was approaching. The B. of L. E. appealed from decision of the Division Superintendent to the General Manager, the Committee of Engineers claiming that both engineer

and fireman saw disc signal at white and claimed statements of their men should be taken against other witnesses. The General Manager confirmed the decision of the Division Superintendent. The case was appealed from one official to another, going up to the highest official of the road, the decision of the Superintendent being sustained up to the last appeal, the engineers meanwhile trying to force their man back at all hazards.

(2) An engineer was discharged for burning a crownsheet of his engine because of low water, the engineer being dismissed after investigation by roundhouse foreman and Master Mechanic. The engineer claimed he would not stand for the decision, appealed to the General Superintendent and then to the General Manager, the decision of the Master Mechanic being sustained. He then took his case up with the Grand Chief Engineer of the B. of L. E., who notified the General Manager that the organization would not stand for the decision, and that it would have a state inspector inspect the boiler of the engine, and it surreptitiously sent an inspector to examine the boiler. This case is still pending, the Grand Chief Engineer claiming that he is going to force it to the end, and that this man shall be reinstated regardless of the facts, which cannot be controverted, as the General Manager of the road in question had the Master Mechanic of another road send its inspector, who made an investigation and a full report confirming the original report of the Master Mechanic who discharged the engineer.

(3) A conductor who refused by telegram to pick up a car when ordered to do so by despatcher, claiming that because he was on through freight he did not have to pick up this car. When the Superintendent wired him to either pick up this car or take his time at the end of the run, he answered that he would take his time. The brotherhood organization struggled for a long time trying to get this man back in the service, claiming that his action was entirely correct, and that the Superintendent had no business to instruct him to do something that was not customary. This case was appealed to the General Manager, by the organization, the action of the Superintendent being sustained.

(4) An engineer on a passenger train collided with another passenger train standing between switches at a station, running clear through the first coach and half way through the second, killing over 40 persons, there being straight track for a distance of over five miles, the marker lights of the standing train burning brightly on a clear night. The engineer being dismissed from the service, the organization appealed from decision of the Superintendent, because it was shown that the flagman was out only about 1,000 ft., the organization of engineers claiming that the collision was the result of the carelessness of the flagman in not being out the full flagging distance, and this case has been appealed from time to time, the organization claiming strongly that the engineer was not to blame.

GENERAL MANAGER.

Feb. 16, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the article in your issue of January 31, with respect to railroad accidents, which I read with a great deal of interest. Every thinking railroad operating officer to-day is greatly concerned about this question. In addition to the accidents that result in loss of life and property, practical officers know of continual slips that "might have" resulted in serious accidents.

It is unquestionably practicable to at least lessen the number of train accidents. On nearly all large systems, the labor organizations have committees who take up nearly every case of discipline. On many of the roads the organizations pay a traveling chairman, whose time is devoted to investigation grievances real or alleged, appealing the discipline from officer to officer, and endeavoring to strengthen the loyalty of the employees toward the organization rather than toward their employers, the railroads. On many of the roads it is a common practice for committees to appeal cases of discipline right up to the Vice-President and President. I have personal knowledge of two instances where the dismissal of conductors for having over-run meets, resulting in serious loss of life, was appealed from the Superintendent to General Superintendent, to General Manager and finally to the President. In both cases the collision occurred 1,000 to 1,500 ft. beyond the switches, and the evidence showed that the conductor could have stopped the train had he been on the alert. I have no doubt many similar cases can be furnished by operating officers on other roads.

On some lines, I am sorry to say, the decisions of the Superintendent are frequently overruled. It is only human nature for a Superintendent, knowing that his decision is likely to be overruled, and that continual appealing by committees is liable to make those in charge regard him as unfit to handle labor, to forego necessary discipline or make it milder than the case warrants. I have read recently a number of results of alleged surprise tests, showing that almost 100 per cent. of the men obeyed the signals, etc. Every practical man will agree with me that if the tests resulted as stated, the men had been advised in advance where and when the tests would be made.

A strictly divisional organization, with the right of appeal in questions of discipline limited to the General Superintendent, together with a continual and properly conducted system of surprise testing, and greater care in the selection of men, will do more than anything else to minimize the number of train accidents. On the road I am connected with, every officer from the Superintendent down is required to make continual surprise tests, submitting a report of them monthly, and it is the intention to transfer to a less active sphere of usefulness such officers as have not the moral courage or backbone to make these tests.

GENERAL MANAGER.

The Draft Gear Line.

Feb. 15, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

One of the points the standing committee of the Master Car Builders' Association is asked to pass upon in connection with its report on friction draft gear is the so-called line of resistance, the committee being asked to "recommend the most desirable resistance during each ⅛-in. compression." This opens up a sea of imagination and theory that is possibly going to flood the committee, as it has sent out to motive power and car men a circular asking for opinions and suggestions.

If there is any hard and fast rule to guide in this matter, it has so far escaped the mechanical engineers who have figured on this thing, for out of any hundred of these men you might select there would be almost, if not quite, a hundred different opinions, all backed up by more or less technical argument, and all more or less right.

Speed Diagram to Illustrate Drawbar Stresses.

The writer does not pose as a mechanical engineer, and is not versed in the science of determining the work done and other items that flow so glibly from this school of students, but there is a parallel in railroad mechanics for determining the proper line, and it is submitted as being the only thing so far discovered that sheds any real and practical light upon the subject. Every railroad owns one or more speed recorders, attached most generally to private cars, and from these can be obtained a graphic record of the speed of trains and the line made in starting and stopping. There is a marked similarity between the service of stopping a train and stopping a car; in fact, the relation between the two is so intimate that it is impossible to disassociate them. Why not, therefore, consult these speed recorder tapes for evidence?

The drawing shown here is taken from the catalogue of the Boyer Speed Recorder, and perhaps is as accurate as any that can be made. It shows a run of 26½ miles of a train at varying speeds, and making stops from 20, 30 and 40 miles an hour. The lines are similar in every case, and if they were inverted would give you some idea of a draft gear line based upon actual practice. If anything is to be deducted from this showing it is that a draft gear should offer to the load a low resistance until the actual stopping is to be effected, and then the line should show a sharp and continuous rise to its ultimate capacity.

X. Y. Z.

[If that portion of the record showing a stop near the thirteenth milepost be taken as typical of the resistances required to stop the train it will be found that their total amounted to 1.85 per cent. of the weight of the train. They include the frictional resistance of the brakes, air, journals, etc., provide the stop was made on a level track. If now the stop were to be made from a speed of 30 miles an hour, as indicated on the record, in 1,625 ft., the approximate total resistance against a car weighing 160,000 lbs. would be about

2,960 lbs. But if this were to be uniformly distributed throughout the entire train, then there would be no compression of the drawbars at all, while if the whole resistance were to be set up from the front end there would be an accumulated pressure at that point equal to 2,960 lbs. less journal and air-resistances, for each car, or for a 25-car train of something between 62,500 lbs. and 74,000 lbs., which the draft gear at the front end of the first car would have to withstand. At the same time, this gear must necessarily support the whole tractive effort of the locomotive, so that the lesson to be learned from an inspection of stop records seems to be somewhat more difficult than would appear at first sight.]—Editor.

Steel Car Design.

New York, Feb. 25, 1908.

To the Editor of the Railroad Gazette:

On page 238 of your issue of February 21, I find that a slight omission in the second column makes the formula read incorrectly. About two-thirds from the top of the page, in the right-hand column, the formula for compression is given as 12,000 — 1 ÷ r; whereas it should read 12,000 — 70 $l \div r$, where l is the length and r the radius of gyration. As it is printed in the paper it is incorrect and would not give satisfactory use in practice.

G. R. Henderson.

The Location of Brake-Shoes.

Feb. 20, 1908.

To the Editor of the Railroad Gazette:

Commenting on the article on brake-gears and slid-flat wheels, in the February 7 issue of the *Railroad Gazette*, I would suggest three objections to the plan of hanging brake-shoes at the height of the centers of the wheels: (1) The brake hangers would be short, resulting in wide variations of their inclinations as the shoes wore. (2) There is greater danger that the brake pressure will force the journal away from the bearing far enough to allow waste or grit to get between them. (2) The pounding between the shoes and heads, the heads and hangers, and the hangers and bearings become severe with a high shoe, while it can be practically avoided with a sufficiently low one.

By inclining the hangers at the proper angle, the shoe pressure can be increased on the forward wheel of the truck and diminished on the rear one. This simple, inexpensive and highly effective method of increasing the efficiency of brakes seems not to be appreciated, though it is perfectly successful when properly designed.

G. E.

The Value of Railroad Records.

New York, Feb. 17, 1908.

To the Editor of the Railroad Gazette:

I read with extreme interest that the Brotan locomotive, described in your issue of Feb. 14, consumes, per 1,000 ton miles, 563 lbs. of coal, and that the standard Austrian locomotives under the same conditions consume 699 lbs. of coal. On the Atchison, Topeka & Santa Fe the coal charged against all the locomotives in freight service on the Eastern division, in Kansas, averages about 200 lbs. per 1,000 ton miles, but on special test runs where every pound used was carefully measured, the actual consumption from train start to train delivery was about 80 lbs. per 1,000 ton miles. Tabulating these different results, we have:

	Per 1,000 Ton-Miles.
Competitive standard Austrian practice	699 lbs.
Brotan locomotive in competitive trial	563 "
Coal charged to Santa Fe freight locomotives	200 "
Actual coal consumed on trial run on Santa Fe	80 "

Question. How much coal ought a locomotive to consume per 1,000 ton miles on a level track in good weather?

What were the conditions that increased the normal consumption from 80 lbs. to 699 lbs.?

Harrington Emerson.

Commerce Regulation in Theory and in Practice.*

There are fortunately only a few subjects of government that cannot well be left to the municipality or state. Yet there are some that can only be dealt with by the central government. At the head and front of these stands interstate commerce. The manufacturer to-day could not sell his products if he were restricted by as many different laws as there are states in the Union. A man shipping a carload of oranges from California to New York would have to send along with the freight a caboose full of lawyers. Our forefathers recognized the necessity of some central control over interstate shipments when they placed the commerce clause in the constitution. The difficulty to make a uniform law to cover this immense subject is seen by the fact that our present Interstate Commerce law, time and again, when laying down a rule, qualifies it by the phrase, "Under substantially similar circumstances and conditions." We read that in the time of Cicero, there was a law that those who forsook a ship should forfeit all property therein, and that the property should belong to those who stayed with the ship. Once in a dangerous tempest all passengers left the ship but one sick man who was too weak to leave with his mates. By chance the ship came to port. The sick man took possession and claimed benefit of the law. All the learned men of the time agreed that the sick man was not in the reason of the law, which was to encourage sailors to save vessels in distress.

I mention this simply as an example of the universally acknowledged fact that all laws should be construed in the manner which will best carry out their reason and spirit. And if this principle of interpretation is true of any law ever passed by man, it is true of the Act which regulates the commerce of this country. We have a good law. It would perhaps be impossible to obtain a better one. Its avowed object is to effect reasonable rates and stop discrimination. All constructions placed thereon should be to that end. These objects, mark you, are co-ordinate, that is, of equal importance. I sometimes think the Act, in its perfectly laudable desire to prevent discrimination, effects a rate which is not only unreasonable but discriminatory. Let us take, for example, the 30-day clause. The theory of this, of course, was to prevent midnight tariffs in favor of large shippers. But how does it work in practice? A bridge is to be erected across a stream near the little town of "X." Perhaps there never was a pound of steel shipped to this place before in the memory of man, and perhaps there never will be again. There are no rates, save the almost prohibitory class rates. The railroad stands willing to publish immediately a commodity rate to "X," which is reasonable and non-discriminatory. But the law says, No. Wait until that rate has been posted for 30 days before you may profit by its terms. The shipper is compelled to hold forwarding of his goods or else pay an unreasonable rate. I submit that this interpretation of the law effects the very thing it was intended to guard against, namely, unreasonable rates.

So again in the matter of the sum of locals versus through rates, we have an example of an impractical interpretation of the law. Suppose the rate from A to B is 10 cents. From B to C is 10 cents, making a combination of 20 cents. The through published rate from A to C is 25 cents. All these rates are properly published and filed with the Commission. Section 6 of the Act says, "every common carrier subject to this Act shall file with the Commission, agreed by this Act, and print and keep open to public inspection schedules showing all the rates, fares and charges for transportation between points on its own routes, and points on the route of another, carried by railroad, by pipe line or by water, when a through route and joint rate have been established. If no joint rate over the through route has been established, the several carriers in such route shall file, print and keep open to public inspection, as aforesaid, the separately established rates, fares and charges applied to through transportation." You will note the statute tells you how to publish a through rate and how to publish a combination rate, nor is it silent as some claim it is, as to which rate shall take precedent over the other. The text of the Act clearly states that charges made for any service rendered or to be rendered in the transportation of passengers or property as aforesaid, or in connection therewith, shall be just and reasonable, and every unjust and unreasonable charge for such service, or any part thereof, is prohibited and declared unlawful. It seems to me where the published combination of locals is lower than the published through rate, the shipper should have the advantage of the lower rate. This has been the universal and undisputed custom since the early days of railroading. Neither has this custom ever worked an injustice nor do we see how it could. Since such is the case, does it not seem unreasonable to so arbitrarily construe the law that the higher rate shall be charged. This impracticable construction is working an injury to-day to commerce.

So it will be seen that any law dealing with as necessarily a practical thing as commerce must in a sense be elastic. The great advantage of the unwritten constitution and unwritten law of England is its elasticity. Each case is regulated by the surrounding conditions. When a legislature endeavors to include all sorts of conditions, in the confines of the law, it is attempting the impossible. The legislatures of several of our states have lately passed laws and I believe Congress is at present considering a law which would make 50 miles per day a reasonable rate for moving freight. I contend that you cannot arrive at a reasonable time by any arbitrary standard. What would be a reasonable time on a 50-mile shipment would not be proportionately reasonable on a 3,000-mile shipment. Again, what would be reasonable on a carload of coal would not be reasonable on a carload of watermelons. Because it is reasonable that it should take two days to haul a car of iron from Philadelphia to New York, a distance of a hundred miles, it does not follow that it would be reasonable to allow a railroad

*From an address delivered Feb. 25 before the Traffic Club of New York, by Charles S. Belsterling, Traffic Manager of the American Bridge Company.

company 60 days from New York to San Francisco, a distance of 3,000 miles. And looking at the question from the railroad standpoint, what would be a reasonable time under ordinary conditions would be unreasonable under other conditions. It is horn book law that negligence is the "want of cars under the circumstances," and no legislature in the world can measure negligence by a yard stick and a Waterbury watch.

The matter of the equipment that a railroad should furnish its patrons is more capable of being regulated by a general rule than the one just mentioned. If there were always an abundance of cars, the distribution would be comparatively simple, but most of us know that there are times of insufficient car supply.

A railroad in its original conception was simply the highway on which tracks of iron or other materials were laid. The vehicles were the means of transportation and were to be supplied by the shipper, excepting, of course, the engine and its fuel. The impracticability of such a custom was soon apparent, and to-day the law compels the railroad company to not only supply the highway, but also the instrumentalities of transportation. All freight tariffs are figured with this in view. Certain industries grow to enormous proportions. Large numbers of cars are required to carry on the business. The railroad company itself had not sufficient faith in such particular business to spend millions of dollars for the necessary equipment. The industry, in order to live, reverted to the original idea and secured its own cars at enormous outlays of moneys. I do not suppose there is any man, save a demagogue or an anarchist, who would question the right of the owner to provide his own cars, yet I fail to see by what theory of law the fact that a shipper has cars of his own should deprive him of a fair and equitable share of the general equipment of the railroad company in its distribution of cars. You must not overlook the fact that millions of dollars that these concerns have invested in private equipment is to-day totally unproductive. At times of car shortage they certainly should have their proportionate share of the general equipment of the road. That they have cars of their own works no hardship on the other shippers. In point of fact, by depriving him of his proportionate share in the distribution of the general car supply, you are taking away from the private car owner a right that he would have had had he not put a dollar in an investment which inured to the benefit of the general shipping public.

So I have mentioned a few instances of the difficulty of regulating practice by theory. There must be elasticity in all the laws pertaining to commerce. When I advocate an elastic law I do not mean an indefinite one, but a law that will allow an honest shipper to move freely without suffering unwarranted injury. There is no greater fallacy than that rigidity of rules will compel honesty. A law, like anything else, when too rigid is apt to be brittle. Especially is this so when applied to trade. Commerce and liberty can go hand in hand. Give us laws; without law there can be no liberty. But just as truly with too much law there is no freedom. It has been said, "commerce is sometimes destroyed by conquerors, sometimes cramped by monarchs; it traverses the earth, flies from the places where it is oppressed and stays where it has liberty to breathe; it reigns at present where nothing was formerly to be seen but deserts, seas and rocks; and where it once reigned now there are only deserts."

Theory is too straight laced. Practice is often too loose as it is very apt to run along the lines of least resistance. It looks to the ends and cares very little for the methods. What we need is the golden mean: where theory will listen to the lessons that practice can teach and practice be guided by the less impetuous and cooler brain of theory.

The Subway Car.

The following report on the subway car of the Interborough Rapid Transit Company of New York City is part of a report to the Public Service Commission of the First District, State of New York, by Bion J. Arnold, Consulting Engineer. It is a full and careful investigation of the general problem of the best type of car for use in rapid transit subways.

The following is the concluding paragraph of Mr. Arnold's letter of transmittal, dated February 18, 1908, to the Commission:

"After studying the conditions surrounding the operation of cars in the present subway, I have reached the conclusion that the present car, when provided with an additional side door located near each end, thus making four doors in each side of the car, will best meet the conditions of the present subway, and that, when these cars are properly operated through the stations as rapidly as the signal system, when modified as recommended in my report of January 18, 1908, will permit, a marked increase in the capacity and comfort of the subway will be realized."

The report follows:

That part of the subway which is of greatest interest to the traveling public is the design and operation of the car. The passenger is mostly concerned about the convenience with which he can get to and from the car which carries him, the ease with which he can enter or leave this car, and the comfort, speed and safety with which it transports him to his destination.

THE PRESENT CAR.

The car equipment at the present time consists of 500 composite cars in which some wood is used, 300 all metal, strictly fireproof cars, and 50 additional all metal cars which have been ordered and are now being delivered, making a total of 850 cars. All of the cars are practically the same size, with seats and doors similarly arranged. Each car is 51 ft. 2 in. over all in length and 8 ft. 7 in. in width and is provided with 52 seats, 16 of which are cross seats near the center of the car, with the other 36 seats placed longitudinally near the end. The cars are as long as the curvature of the tracks will admit, and as wide at the top as the clearance on critical curves will allow. All the cars have closed vestibuled platforms, with sliding doors, instead of the usual gates. The accompanying drawing indicates the seating plan and general dimensions of the car.

The operation of these cars in actual subway service has disclosed certain fundamental defects in design which should be remedied before the subway can furnish the speed, comfort and capacity which the passenger has a right to expect.

PRESENT SERVICE SUPPLIED.

The distinguishing feature of the subway is the intimate connection between the local and the express tracks. Of the four parallel tracks extending between Brooklyn Bridge and 96th street, the two center tracks are used for express trains running on a time-table which requires a schedule speed of nearly 25 miles per hour. Between Brooklyn Bridge and 96th street these express trains stop only at 14th street, Grand Central Station and 72d street, and they are scheduled to make this run of nearly 6½ miles, including the three intermediate stops, in 16 minutes. During rush hours, however, on account of excessive station waits and the resulting caution signals, which require reduction in speed, this run usually takes 18 to 20 minutes, and often much longer.

The local trains are scheduled to make this same distance between Brooklyn Bridge and 96th street in 26 minutes, the additional 10 minutes being due to the four extra intermediate stops made by the local trains between express stations. In actual service during rush hours the local trains usually require from 28 to 30 minutes, and sometimes more, the delay being caused by the long station waits at the express stations.

At each express station the passenger has the privilege of transferring from the local trains to the express trains, and vice versa, and, to facilitate this transfer, the five express stations are arranged with island platforms between the tracks, so that the passengers can leave the trains of one service, cross the platform and directly enter the cars of the other service, and this privilege is much used and even, to a great extent, abused.

Owing to the excessive use of this transfer privilege, many passengers, in traveling from their starting points to their destinations, are loaded and unloaded twice, and a large number of them three times, so that many of the passengers use the car doors four times, and some six times, while in an ordinary railroad without the transfer privilege the car doors are used but twice by each passenger. On account of the excessive use of the doors, the present type of car, which ordinarily gives satisfactory service, has proved to be extremely inadequate for the subway.

Some of the express stations have been built with separate local platforms, but, on account of the confusion resulting from the use of two platforms serving one train, these local platforms have been abandoned and closed up, except at the 96th street station.

The express station platforms are nearly all 350 ft. long, and at present serve 14 of the 16 doors on one side of an 8-car express train, thus leaving the first and the last doors without platform service. Most of the local platforms are 200 ft. long, and are arranged to serve 8 of the 10 doors on one side of a 5-car local train, the first door and the last door of these trains being out of service at all times.

At the time my study of the subway began (October, 1907), the schedule or time-table on which the cars were run called for 30 trains per hour during the rush-hour periods upon both the local and the express tracks south of 96th street. Owing to the excessive delays of the trains at the station platforms, the schedule was not maintained, invariably falling to less than 27 trains per hour at Grand Central Station, during the morning and evening rush. Recent improvements, however, have made it possible, except on very busy days, to get 30 trains an hour through the limiting stations on both the local and the express tracks.

Each express train consists of 8 cars, and each local train of 5 cars, and each car contains 52 seats. Under these conditions, the number of seats per hour which pass a given station are (30 x 8 x 52) or 12,480 seats on the express tracks, and (30 x 5 x 52) or 7,800 seats on the local tracks. Actual records show that during the rush hours the cars often carry twice as many passengers as there are seats, and that during the height of the rush period there are times

when three times as many passengers are carried on some express cars as there are seats, although the latter condition exists only for short periods of time on very busy days.

Since the opening of the tunnels to Borough Hall, Brooklyn, on January 10, 1908, a schedule has been prepared calling for 40 express trains per hour between 96th street and Brooklyn Bridge during the rush periods, this schedule having been adopted in order to provide the Brooklyn extension with 20 trains an hour, corresponding to a 3-minute headway. The delays of the trains at the station platforms, however, have seriously interfered with the carrying out of the improved schedule, and, although there are parts of the system where 40 trains per hour are supplied during certain periods of the day, this rate is not maintained at the critical part of the rush-hour period, the time when it is most needed. In other words, as soon as the demand for seats increases beyond a certain limit, the supply of seats begins to decrease.

ANALYSIS OF DELAYS AT STATION PLATFORMS.

The present arrangement of loading and unloading passengers through the same end doors of the cars is the chief cause for the inefficient operation during the rush-hour period. The crowded condition of the car entrances and station platforms under the present arrangement results in passengers leaving the cars in single file and with considerable difficulty and discomfort. The unloading under such conditions usually requires from 15 to 30 seconds, and in extreme cases 50 seconds during the most congested period at the principal points of transfer.

Passengers desiring to board the cars must wait until the unloading has been practically completed, unless they wish to force themselves against the outcoming passengers, and this loading must be effected quite frequently through an entrance obstructed by passengers waiting to get off at nearby stations who prefer to hold their positions and thus obtain an earlier and easier exit. It will be seen, therefore, that the streams of outgoing and incoming passengers not only meet, but do so under peculiar and trying conditions, as the same doorway is used for both entrance and exit.

An analysis of the average time required by an express train at a station platform during the height of the rush hours shows the following figures:

		Average
1.	To open doors of cars after train has stopped	2 secs.
2.	To unload an average of 163 passengers through 14 doors (15 to 50 seconds)	20 "
3.	To load an average of 206 passengers through 14 doors (15 to 30 seconds)	20 "
4.	To close the car doors and give the signal by means of bell-rope to motorman.	13 "
5.	Total average time of express trains at station platforms between stopping and starting during the height of rush hours.	55 secs.

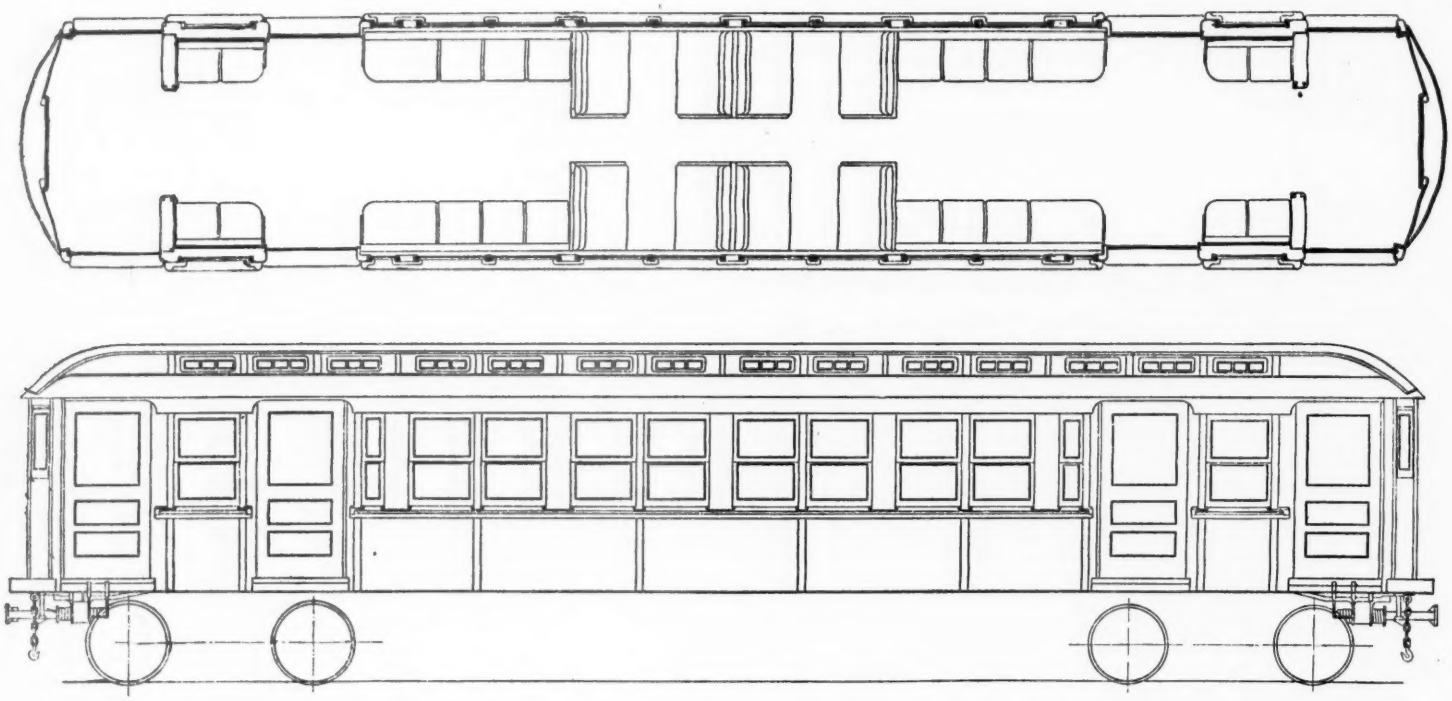
DEFECTS IN PRESENT ARRANGEMENTS.

Two of the defects which stand out prominently in the operation of the subway are, first, the excessive use of the transfer privilege, and second, the use of the same end doors in the cars for both the entering and the leaving passengers.

Apparently the only permanent way to improve these conditions is either to reduce or abandon the transfer privilege, or to change the car.

There are several ways in which the transfer privilege could have been reduced or curtailed. For instance, at Grand Central Station and at 14th street, where the greatest amount of transferring is done, separate platforms might have been arranged to serve the local and the express trains, but this would have made it necessary for all passengers wishing to transfer from one service to the other to climb the stairs from one platform to the mezzanine walkway which connects all platforms, and go down again to the level of the platform serving the other train. As the maximum time that can now be saved by transferring from a local train to a northbound express train at Grand Central Station is 4 minutes, and the average time saved by transferring at 14th street is about 6 minutes, and, as it would require on an average 2 minutes of this time to make the transfer on account of the necessity of climbing up and down the stairways, it will be seen that much of the present unnecessary transferring at these two points might have been discouraged by the use of separate platforms.

It is also possible to divide the island platforms longitudinally at certain express stations by means of a central iron fence, which could be provided with gates, to be closed at such times as it would be absolutely necessary to discourage the present practice of excessive transferring. These gates could be closed, for instance, at the times during rush hours when a local train and an express train both occupy the station platform, so as to make it possible to rush from one train to another, but they could be open at all other times. With the present narrow platforms, this dividing fence would add considerably to the platform congestion, and thus would interfere with the prompt handling of the passengers, who must necessarily use the station. Unless the platforms were widened these dividing fences would probably cause as much discomfort and loss of time as their use would obviate, and, therefore, with the present subway these fences would not prove to be a comprehensive solution of the transfer problem.



Plan and Elevation of Recommended Type; Present Subway Car Altered to a Car with Double Doors Near Ends.

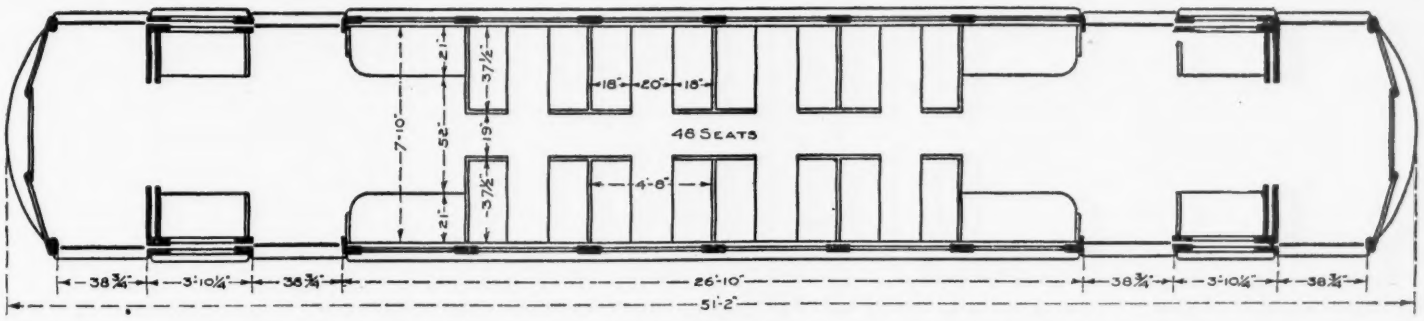
As the public for the past three years has enjoyed the advantages of a simple and ready means of transferring from one service to the other, and as any introduction of difficulties in connection with this process of transferring will savor of the withdrawal of privileges, I am sure that any attempt to improve the service by rearranging the station platforms so that those desiring to change from local express service, or vice versa, would be delayed, would meet with strenuous objection, and, with the present subway, would not be justified. While it may be contended that such convenient means of transferring at so many points should not have been provided, it is my opinion that this principle, having been established, cannot now be withdrawn, and that the only remedy, therefore, is to change the cars.

It has been suggested that even with the present car the passengers could be made to enter at one end door and leave at the other end door, but when it is considered that passengers leaving the train at the express stations under this regulation would be forced to push their way past every standing passenger throughout the entire length of the car, and that this discomfort to all would be constantly recurring during the rush hours, it can be understood that this solution of the difficulty would be neither popular nor efficient. Furthermore, if the entering passengers were to be confined to the use of one door in each car, and the leaving passengers

to the other, the number of entrances to the train would be cut from the present number of 14 to a maximum of 8 doors, and the exits likewise reduced. This would be a disadvantage, particularly at 14th street, where the great majority of passengers using the car doors of the local trains are leaving passengers, and those using the express trains are entering passengers. Moreover, since the present station platforms are not long enough to serve the doors at the extreme ends of an 8-car train, it would be impracticable to establish a circulation in the end cars.

The present car works very well during periods of light and fairly heavy travel, but as soon as it is called upon to carry upwards of 100 passengers, the single-end doors become a decided disadvantage, and their inefficiency in handling large crowds seriously interferes with the prompt movement of the trains. It might be maintained that all of the passengers who *should* be carried in the cars can enter and leave the present end-door cars within the time to which the station waits should be limited, and that any further loading of the cars should be prohibited and prevented. If there were other ample and equally as good means of transportation paralleling the subway, this regulation of the amount of loading would be a practical solution of the difficulty, but until other subways are built, the people will demand transportation in the present subway even at the sacrifice of comfort, and, therefore, every effort should be made to give transportation to as many as possible. As the limit of capacity under present circumstances will be the maximum carrying capacity of the car, it is essential that a type of car be used in which this limit can be easily and quickly reached.

In order to accomplish this purpose it is clear that the ease of loading will be greatly increased when the entrance is cleared to a great extent of passengers waiting to leave the car. Passengers could be handled with greater ease and comfort by having separate doorways for exit and entrance and the process of unloading and loading should take place simultaneously, thus reducing the station wait now required by nearly or quite one-half. To state the case briefly, the principal defect in the present car is due to the fact that a definite and ready circulation of traffic is not provided for and that owing to the lack of sufficient doors properly located, the maximum carrying capacity of the car cannot be easily and quickly reached.



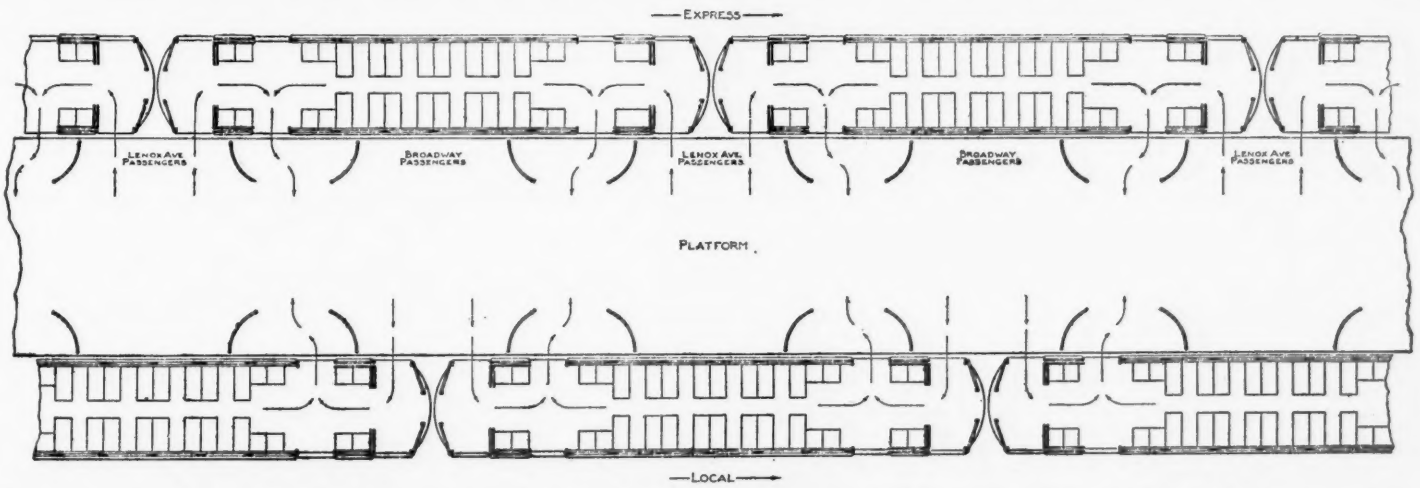
Recommeded Future Car for Present Subway; Car with Double Doors near Ends, Combining Cross and Longitudinal Seats, Seating Capacity 48; More Compact Seats Than in Present Car.

POSSIBLE IMPROVEMENTS.

In my preliminary report reference was made to the excessive time required by the express trains at the station platforms during rush hours, which the record showed to be 65 seconds at that time (November, 1907). Suggestions were therein made with the idea of limiting these station waits, if possible, to 45 seconds. Many of these suggested improvements have been put in operation, but the subway officials are of the opinion that it is impossible to confine the waits to the 45-second limit suggested in that report. Their efforts, however, in improving the service have resulted in cutting these station waits down from an average of 65 seconds to an average of 55 seconds.

In the preliminary report referred to, I pointed out the fact that if the wait at the station platform could not be limited to 45 seconds by efficient methods of handling the passenger traffic, it would be necessary to consider an improved type of car which would accomplish this result. As the station waits have not been thus limited by the subway officials, and, further, as it is their opinion, as expressed in their reply to my preliminary report, that it will be impossible to always limit these waits with the present type of car to the 45 seconds, it is necessary to consider a car designed so that it will considerably reduce the present platform delays.

In my study of the signal system I found that the trains can be run *between* stations on a headway of 90 seconds, or at the rate of 40 trains per hour. However, on account of the delays at the station platforms and also on account of the arrangement of the signals on the tracks approaching the stations, it is just possible under present conditions to pass 30 trains an hour *through* the busiest stations during rush hours. Changes in the signal system were pointed out which would make possible a headway of 105 seconds (34.3 trains per hour), even with the present car, and still allow a station wait of 50 seconds. If the platform delay can be reduced to 35 seconds and the signal system improved as suggested, then it will be possible to get the trains through the limiting stations in 90 seconds, thus maintaining a headway of 1½ minutes, corresponding to the capacity of 40 trains per hour, which is the maximum rate at which the signal system between stations will allow trains to pass.



Arrangement of Guiding Rails on Subway Station Platforms, to be Used in Connection with Recommended Type of Altered Car.

To secure the desired capacity of 40 trains per hour without making any changes in the signal system, will require that the station wait be limited to 20 seconds. To thus limit the time required for unloading and loading the passengers and for opening and closing the car doors and transmitting the starting signal to the motorman to 20 seconds, means an entirely different type of car than that used at present and a rearrangement of the stations, as this result could not be accomplished without the use of a large number of doors along the entire length of the car and suitable gates for preventing an excessive number of passengers reaching the car at any one time. In other words, if the present arrangement of signals is retained, the only possible way to secure an increase in the capacity of the subway from 30 trains per hour to 40 trains per hour is to scrap or use elsewhere the entire subway car-

body equipment and build new cars at an expense of at least $5,000,000, and to rearrange the present platforms, which is practically prohibitive.

If on the other hand, the signal system can be improved in such a way that even the present trains can be passed through the stations on a headway of 105 seconds (1¾ minutes) it will require only a comparatively simple alteration in the car to reduce the allowed stop of 50 seconds to 35 seconds and thus secure the 15 seconds' saving which will make the desired 90-second headway possible. The most economical and efficient as well as the quickest way, therefore, to secure a capacity of 40 trains per hour in the subway is to improve the signal system (as recommended in my report of January 18, 1908) and at the same time alter the present cars sufficiently to limit the platform waits to a maximum of 35 seconds. It should be understood that this 35 seconds is a limit which, if exceeded, would at once affect the headway, and that the average platform delay should be somewhat less than this limit in order to provide a leeway for operating exigencies.

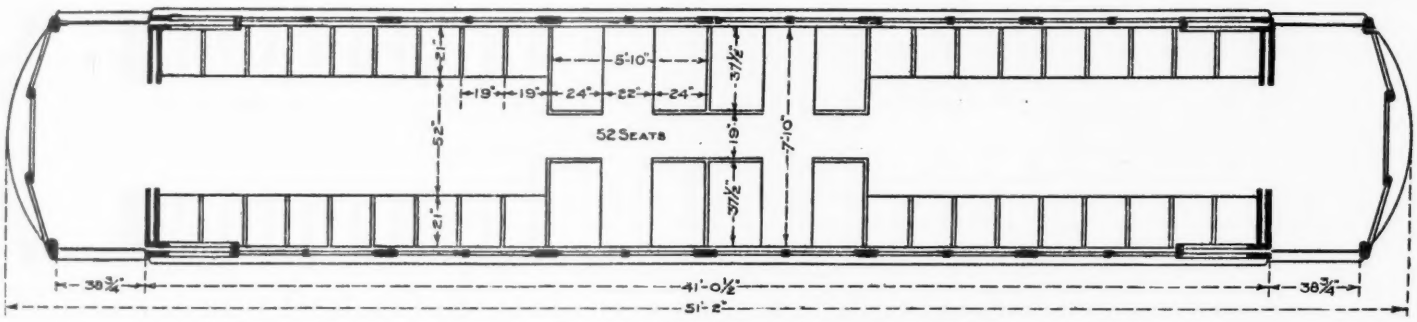
To secure this result it is evident that the loading and the unloading must be carried on at the same time. Some improvement should also be expected from the use of pneumatic door-handling equipment and an electric door signal. These changes should easily bring the actual wait at the station platform down to the following figures:

1.	To open doors after train is stopped.	2 secs.
2.	To unload 163 passengers through 14 doors, and to load 206 passengers through separate doors, both processes being carried on at the same time.	20 "
3.	To close doors and give signal to motorman	8 "
4.	Total average time of trains at express stations during rush hours should not exceed.	30 secs.

ARRANGEMENT OF SEATS.

From the foregoing discussion it is plain that in order to run 40 trains per hour through the subway, it is essential that more door openings be provided than are found in the present cars.

There are a number of different types of cars which will provide extra doors, thus reducing the station waits and increasing the present number of cars which can be run through a station during rush hours. Each type, however, will allow for a number of different arrangements of the seats, and therefore before taking up the most desirable location of these extra doors, it will be well to discuss the arrangement of seats in order to determine how best to utilize the additional carrying capacity provided by the increased number of trains.



Plan of Present Subway Car, Showing Arrangement of Seats and Single Doors at Ends.

Before determining upon the proper arrangement of the seats, the question of policy submitted to your Honorable Commission in my preliminary report of November 26, 1907, must be decided. In that report I requested a decision as to whether the capacity of the subway should be limited to the number of passengers who could be carried if the cars contained the maximum number of seats, or whether it would be preferable to sacrifice somewhat the possible number of seats, thus providing a relatively larger amount of standing room and correspondingly increasing the total carrying capacity.

Not having been instructed by you on this subject, in order to complete my report upon the subway car I take the liberty of suggesting the following policy for your consideration:

It seems to me that it should be the aim to eventually provide a seat for every long-haul passenger, but until this can be at least approximated by the construction of additional subways or other transportation lines, it will be necessary to furnish transportation for all, even though existing conditions compel many passengers to stand during rush hours. While it seems at present impracticable to provide seats for all except during non-rush hours, every possible improvement that tends in this direction consistent with justice to the subway company should be made, in order to gradually reduce the proportion of standing passengers to those seated, and no change should be allowed which will reduce the total number of seats per hour now provided by the subway cars.

It has just been pointed out that the maximum number of cars per hour can be secured only by the introduction of additional side doors in the cars. Although these extra doors may slightly reduce the seating capacity per car, their use should so limit the station waits that the total seating capacity carried by a station within a given time is not reduced from the present number of seats. In other words, the rule should be that the increased number of seats made available by the extra cars must be at least equal to the total number eliminated on account of the space occupied by the extra doors.

Owing to the overloaded condition of the subway it will be necessary for the present to utilize the extra carrying capacity made available by the additional cars for standing passengers, until such a time as additional subways can be built. If these subways are built sufficiently in advance of the demand for sub-surface transportation, a part of this extra space can eventually be fitted with seats and thus approach nearer to the condition of a seat for every passenger.

If 40 trains of eight cars each are passed through a station each rush hour, each car having additional doors to provide for the more comfortable and rapid handling of the passengers, it will require but 40 seats per car to provide the same number of seats that are at present supplied by 30 eight-car trains per hour. The new cars, therefore, should not have less than 40 seats. Any greater number of seats than 40 per car will indicate a corresponding increase in the total number of seats available.

The number of seats which can be placed in a car depends upon the type of seat, and there are three kinds of seats which by common use have become standard practice in cars of the subway type.

The longitudinal seat usually occupies a space 19 in. in length along the side of the car. This type of seat has long been in use in surface cars, in many elevated cars, and the ends of the present subway cars.

The cross-seat of the "back-to-back" type has been adopted for use in the center of the cars on a number of elevated urban roads and for the present subway car. As the elbow of the passenger occupying the seat next to the aisle can encroach upon the aisle space, only 18 in. in width is required for each passenger. The space between the seat cushions varies from 14 in. to 30 in., a fair average being from 18 to 20 in.

The cross-seat of the "walk-over" type is being quite generally adopted by the interurban electric roads and by a number of city lines. A width of 17 in. per passenger makes the seats 34 in. wide, although in some instances, such as the new cars now in use in Chicago, the seat is 36 in. wide. The distance from the center to center of back varies from 27 in. to 36 in., a fair average for a properly designed seat being about 30 in.

The advantages and disadvantages of the various kinds of seats are pointed out in discussing the possibilities of seating arrangements in the different types of cars which are most suitable for subway conditions.

TYPES OF SUBWAY CARS.

A successful car for the present subway should possess as many as possible of the following requirements:

1. Separate entrances and exits.
2. A space which can be cleared so as to be ready to quickly receive the passengers boarding a car.
3. Convenient means of circulation inside a car.
4. Standing-room space contiguous to the exits.
5. As many cross-seats as practicable.
6. Exit and entrance doors sufficiently removed from each other to allow for the car's stopping convenient to guiding rails on the platforms.
7. Doors located so as to minimize the danger from open spaces at curve platforms.

The various cars may be classified in accordance with the number of doors in the sides of the cars as follows:

Cars with central side doors and end doors.
Cars with two quarter side doors.
Cars with three doors near center.
Cars with multi side doors.
Cars with double doors near ends.

Each one of these types may have seats of either the longitudinal, the cross "back-to-back," or of the "walk-over" style, or

a combination of two or more styles, as will be shown more in detail as the cars are described.

CARS WITH DOUBLE DOORS NEAR ENDS.

Without weakening the present car, or adding materially to its weight, it is possible to introduce additional side doors, one near each end of each side of the car and as near as practicable to the present end doors, the distance between the doors being at least sufficient to furnish a pocket for the sliding doors.

It will be seen by referring to the accompanying drawing that these additional doors can be added without disturbing the present seating arrangement of the car to any great extent. It is true that the introduction of these doors will make it necessary to remove eight seats from each car, but the operation of the cars in actual service will make it possible to pass so many more cars through the subway that the loss of eight seats in each car will be more than offset by the additional seats in the added cars, and the extra standing room, so convenient to the separate exit, is a feature which will decrease the station waits, and thereby increase the schedule speed.

This proposed change in the present car has many advantages, which even a casual study will reveal. The new doors can be used for exits, and the present end doors for entrances, thus providing at once the means of carrying on the process of unloading and loading simultaneously and without the present conflict which during rush hours has become so objectionable.

This car provides a separate space for leaving passengers to collect around the exit doors without blocking the space which should be provided for the passengers entering the car. The result will be that passengers will move in and out much more quickly than at present, and the movement of passengers into the car will facilitate the movement of passengers out of the car.

With this car it would be possible to keep the platforms clear of standing passengers, particularly at the time of approaching a station where considerable additional load is to be expected. With the present cars it is impossible to keep the platform clear, as the passengers readily make the excuse that they are getting ready to leave the train at the next station. With a clear platform there should be none of the discomfort now experienced in boarding a crowded car; the passengers will pass rapidly into the empty car vestibule, and can move at once into the space which has been vacated by the leaving passengers.

There should be no hesitation on the part of a passenger in the selection of an entrance with this type of car, as is so often the case with the multi side-door car. Under these circumstances there is no reason why a rate of flow of passengers in and out of the car amounting to at least five passengers per car per second should not be expected with this car with double doors near the end, and this rate is fully as good as the experience in Chicago would lead us to expect from the multi side-door cars, even with eight doors distributed the entire length of the car.

While this type of car provides for setting up and maintaining a circulation, this circulation is not obtained at the expense of comfort to the through passengers, as the circulation is confined to the two ends of the car, and it is therefore not necessary for a passenger boarding a train at one station and getting off at another to pass through half the length of the car, with the attendant discomfort to both himself and to all of the other passengers in the car.

Both the exit and the entrance doors are directly under the eye of the guard, who is thus in a position to accentuate the circulation, and, therefore, the rapidity of handling the passengers, by opening the exit door slightly in advance of the entrance door, which can easily be done by either mechanical or pneumatic means.

This car lends itself readily to the introduction of platform railing at all of the more important station platforms. These railings can be arranged as shown in the accompanying diagram, which will indicate at once the advantages of collecting the passengers who are waiting for a train at definite loading points, thus leaving the remaining parts of the platform free and ready to receive the unloading passengers. This particular double-end-door car fortunately allows for an arrangement of platform railings in such a way that loading points can be provided for the Broadway passengers separate from those set apart for the Lenox passengers. Should the distance between the doors as shown be considered too close for ease in stopping at the proper points, the distance could be increased by moving the supplemental doors one seat nearer the center of the car.

The standing room in this car can be increased during rush hours by folding up the two seats between the doors, and, while this practice is not to be commended, there will be times, and particularly on heavy days, such as Mondays, when this feature could be utilized.

The present cars can be changed to conform to this arrangement for an expense of about $2,000 for each steel car, and about $1,500 for each composite car.

For the present subway this car seems to me to possess more advantages and fewer disadvantages, both from the standpoint of the public and the operating company, than any other type, and its use will increase the capacity of the subway sufficiently to fully justify the expense of altering the present cars into cars of this type.

RECOMMENDATIONS.

My recommendations, summarized, are as follows:

First.—That every car used in regular passenger service in the present subway be provided with two additional side doors, located near the ends, approximately, as shown in the drawing already mentioned. I recommend this car for the following reasons:

A. The double-door space at each end of the car will greatly reduce the present station waits.
B. The separate exits and entrances will remove the present uncomfortable conflict at the car doors.
C. The present cars can be altered to this type of car without detracting from their structural strength, or materially altering the present seating arrangement.
D. The result in increased carrying capacity due to changes will abundantly justify the investment.
E. This is the only type of car with additional doors that will not materially increase the present trouble due to curved platforms.

Second.—That all cars be provided with pneumatic or other means for quickly opening and closing the doors, and with signals, which will automatically indicate to the motorman when the last door is closed.

Third.—That all new cars bought in future be of metal and provided with seats more economically arranged, as shown in the accompanying plan.

Fourth.—That when the cars of the double end-door type are put in service, a system of platform railings, similar to that shown in the accompanying plan, be provided to direct the passengers.

Fifth.—That for future subways a wider car should be considered. This car may be a multi side-door car, if separate platforms can be arranged for each class of trains, and if the stations can be designed to control the flow of passengers at the entrance to the platform, instead of directly at the car doors. If, however, it is found that it is impracticable to design stations with sufficient room for waiting passengers independent of the station platforms, it will probably be found that the best car for future subways is a wide car of the type with double doors near ends.

Sixth.—That if it is found that future subways cannot be built without the occasional use of curved platforms, the cars for these future subways should be designed so as to allow the station platforms to extend under the car in such a way that the necessity for sliding platforms will be obviated.

[The part of the report given above covers the general discussion of the problem, a description of the recommended type to which the present subway cars should be converted and Mr. Arnold's general recommendations. The report also includes an extended discussion of the various types of subway cars and the various kinds and arrangements of seats in them. This will be published in a later issue of the *Railroad Gazette*.—EDITOR.]

Perkins of the Burlington.*

Charles Elliott Perkins, who was for some 20 years president of the Chicago, Burlington & Quincy Railroad, was a strong personality with a marked and effective individuality. He was honored, respected and beloved, and his character, which was typical of the age which produced him, is for all time inseparably connected with the history and the development of the Middle West during the past 50 years.

As a railroad builder he was perhaps as great a strategist as any man this country has produced; and yet his name will never be connected with those who, in undertaking daring things, have brought ruin to themselves and their associates. With all of his personal courage and his unwavering faith in the future of the West, he was a man who recognized his position of trusteeship for others. There was a very strong line of division, as he viewed things, between his rights as an individual and his duties as a trustee and guardian for others' interests. This very quality made him a careful and safe guide, and made the railroad, the development of which he presided over, a wonderful example of careful and sound financing, and well able in times of stress and money panics to weather the fiercest storms.

In 1901, when the sale of the Burlington was made to interests representing the Great Northern and Northern Pacific roads, he showed not only his business sagacity, but his determination to protect to the fullest extent the interests of all the stockholders. Before negotiations had been opened for the purchase of the road he had learned that a considerable portion of the stock had been bought in the open market. In fact, to his surprise, as well as that of other directors of the company, many of the so-called "widows and orphans" and little stockholders of the company in Massachusetts, who had held the stock for years, had parted with their holdings to the syndicate which was making the purchase. As soon as Mr. Perkins

*From an article by Frederic A. Delano, President of the Wabash Railroad, and formerly General Manager of the Chicago, Burlington & Quincy, in *Appleton's Magazine* for March.

saw what was going on, he at once entered into negotiations with the syndicate, taking the position with his own directors that it would not do to let this syndicate acquire a majority of the stock and leave the minority stockholders to take what they could get. The result, as is well known, and now a matter of railroad history, was that a proposition was made by the purchasing syndicate and submitted to all stockholders alike, and finally accepted and ratified by upward of 97 per cent. In other words, regardless of his own personal ambitions, for it must have been a keen disappointment to him to part with the control of a property with which he had grown up, he concluded an arrangement for the sale of it which was as fair and as liberal to the interests which he felt it his duty to protect as it was possible for such an instrument to be.

Mr. Perkins saw the state of Iowa grow from a population of some 675,000 in 1860 to a population of 2,232,000 in 1900; he saw the Burlington road develop, and actually and personally superintended the construction of much of its mileage, from a railroad of a few hundred miles to one of more than 8,000, opening for development 14 states; and yet, such was his modesty and such his insistence on remaining in the background that he was far less in the public eye than many men who have achieved only a fraction of what he did. He belonged to the class of men which, in the nature of things, must grow fewer as time goes on—men who have great constructive gifts and who have had the opportunity to develop and work in a new country, free and untrammeled by precedent or conventionality.

Starting out from a small position in the railroad he became paymaster and assistant treasurer, and soon the general superintendent. But the road of which he had charge extended only from Burlington to Ottumwa, 76 miles, and as it grew and developed he grew and developed with it. When it was merged with the Chicago, Burlington & Quincy, then wholly an Illinois corporation, with a mileage of some 210 miles, he was for a time put in charge, as vice-president, of the Burlington & Missouri River Railroad, in Nebraska, which extended then from Plattsmouth, Neb., to Kearney and was being developed in a wholly new country. This was only a temporary assignment and he retained his headquarters at Burlington. In 1881 he was made the president of the united company—the Chicago, Burlington & Quincy.

With the increased importance and responsibility of this position, he was one of the most influential and best-known railroad men in the western country. During the prosperous years which followed, the road was extended to ramify through a very large area of Nebraska and beyond it into the states of Colorado, South Dakota and Wyoming.

The Burlington became the leader of the granger roads and its stock a favorite investment for trustees and others. The management of the road was successful and efficient, and the property well maintained. It was naturally so under such a leadership. Indeed, to have grown up and to have done creditable service in the "Burlington school" was as good a diploma as a railroad man could ask for. The graduates of this school have carried its influence far and wide throughout the country. Included among them are four railroad presidents, Edward P. Ripley, of the Santa Fe; Howard Elliott, of the Northern Pacific, and George B. Harris, now President of the Burlington. [The fourth is Mr. Delano himself.—Editor *Railroad Gazette.*] Paul Morton, of the Equitable Life, is a Burlington graduate; so is W. C. Brown, the Senior Vice-President of the New York Central lines. Out of many men of prominence may be mentioned a few such as C. M. Levey, Third Vice-President, and H. C. Nutt, General Manager of the western end of the Northern Pacific; George W. Holdredge, General Manager of the Burlington lines west of the Missouri; T. E. Calvert, now Chief Engineer of the Burlington system. Among those who have passed on may be mentioned T. J. Potter, once the Vice-President of the Union Pacific, and Henry B. Stone, who left the Burlington to become the President of the Central Union and the Chicago Telephone companies.

All through American railroad service are to be found men trained by Mr. Perkins to be "thorough" railroad men. Thoroughness was something that he insisted upon. Mr. Perkins never liked to hear a man spoken of as "a good operating man," "a track man," "a motive power man." He wanted "railroad men"; that is to say, all around and efficient "business" men. He believed that fundamentally a railroad was a commercial enterprise and should be governed accordingly both in its management and its relations with the public. He dealt with the fundamentals, with the underlying principles of railroading, and to serve under and in close contact with him was an inspiration. He was quick to form his judgment of men, and when he decided that he could place his faith in one, his method of developing him was to give him large responsibilities. To those who knew him not he was at times brusque, for he could assume an almost fierce manner. He was a big man physically, and untiringly active. Both his father, the Rev. James Handasyde Perkins, and his mother, Sarah H. Elliott, were of Puritan stock, and he had many of the Puritan qualities, mellowed perhaps by the western environment in which he grew up, for in 1840 Cincinnati, where he was born, was pretty close to the frontier.

He received a common school education, and being the oldest son in a minister's family, it was necessary for him to go west at the age of nineteen, not only to become self-supporting, but, in the then familiar language of Horace Greeley, to grow up with the country. He went to Burlington, Iowa, in 1859. Leading business men in our larger cities often wondered that Mr. Perkins was content to remain in a small town, for he retained his residence in Burlington until the end of his life. They marveled that he did not come to live in some great city where he might be in closer contact with men of equal prominence and ability; but, in this particular, Mr. Perkins showed his character as clearly as in any other. It was his thought that a man could do his work better if freed from the diversions and distractions of the city life. He preferred to keep a little apart from these conditions and exactions of the city, and remained in his country home—a home where he was surrounded by every possible comfort, yet where he avoided every evidence of display and magnificence.

He was a profound student of the problems of every-day life, and, while not a university man, he was a man who, by close reading, had trained his mental qualities to an exceptional degree. There was scarcely a single broad question of policy concerning the duties of an officer of the railroad, the functions of the railroad or its relations to the public, upon which he had not prepared "memoranda"—papers which were comprehensive and thorough in the fullest degree. Then, again, he liked to associate with men who were thorough, painstaking and forceful. He loved to have young men about him and to discuss and argue with them on every conceivable topic. He liked opposition if it was intelligent and backed up by sound reasoning. Needless to say, he hated hypocrisy and demagoguery in any form.

A contemporary of Mr. Perkins in railroad administration, himself a man of notable ability, said of him recently, that he knew of no man in the profession of better intellectual capacity and training, no man so well equipped to understand all the problems, technical, economical and commercial. High praise this, for a man who had acquired this equipment wholly by his own labor.

People who knew him best in the community where he lived and along the line of the railroad which he managed for so many years, knew that he appreciated in a way that few railroad executives have appreciated, the true importance of the good will of the community with which he did business. He laid the greatest possible stress, in the organization which he developed, on the importance of local self-government. While he appreciated fully the advantage of supervision by centralization of authority, he recognized and always preached the importance of letting the man on the ground have the authority, the tools and the men to do with.

The railroad over which he presided was not only recognized as a model of honest management and careful capitalization, but it also enjoyed an almost unexampled popularity and even affection in the communities along its line. His idea of keeping a community satisfied was to give all the service which it could reasonably demand, and yet he did not tamely submit to harsh treatment or exactions. Indeed, few men ever fought more stubbornly for the rights of their stockholders against some of the senseless legislation resulting from the wave of popular hostility in the Granger movement and afterward. He should have the credit, more than any other one man, of supplying the initiative and the arguments which finally secured a decision from the United States Supreme Court in favor of the railroads in the "Nebraska Rate Case." His logical mind, his capacity for reasoning closely and clearly, and for analyzing complex questions made him alike a strong advocate and a powerful combatant.

It is not to be supposed that this man's career was one unbroken procession of triumphs. He had his trials and his sore disappointments, as many another, bearing them so manfully withal that few ever knew of them; but in his railroad career, perhaps, his hardest experiences were the repeated disappointments in carrying out his ambitious plans for the development and extension of the Burlington road. Without criticising his associates and directors, who took what they thought to be a safer and more conservative course, he was keenly disappointed that he could not make them appreciate the grand opportunities which lay before them; first, in the purchase of the then bankrupt Northern Pacific, and later in the purchase of the Oregon Short Line. Finally, of course, the loss of control of the property by his friends was a severe disappointment, but, after all, to his reasoning mind, only a natural sequence of the failure to grasp opportunities which had been offered and had been allowed to slip.

With all of his great qualities as an administrative and executive officer, so successful in his achievements, Mr. Perkins was even more. He was a great, large-hearted, generous man, doing in a quiet way many things for his friends and neighbors. He was capable of inspiring in his associates loyalty and devotion to a remarkable degree, and yet he was exacting in his demands for thoroughness and accuracy, while generous in his approval of work well done. His life-work is a sufficient monument to him, but the business ideals and the inspiration which he gave to many a man who came under

his influence will perhaps mean even more in the long run.

After all, the most encouraging thing that can be said is that Mr. Perkins' methods and his success were not absolutely unique, for he was a product of American civilization, a thoroughly typical American. In these days when sensationalism runs riot and public attention is constantly directed to everything unfavorable, it is worth while to remember that there are such men, and to realize that business methods are fundamentally sound, for the reason that men in business believe, and fortunately so, that corporations must be fairly conducted in order to survive.

Picked Up on the Road.

BY GULF.

Every one ought to have read the discussions on track stresses on curves that have been published during the past year, if only from curiosity to see how men are seeking the solution, though it must be admitted that the mathematics of the case has many will-o'-the-wisp features. Mathematics is an exact science, but its usefulness depends on correct premises. When we have an equation of two unknown quantities that are treated as variables, the construction of the line by the assignment of a known value to one of them is an easy matter, but when it comes to solving an equation involving a score or more of unknown quantities, the case assumes different proportions. If we could know the value of all of the variables that enter into and affect the pressures of the wheel on the rail, then there is no doubt that a mathematical solution of the result could be obtained. But who knows the values of these elements? For example, who really knows the simplest one of the lot—the height of the center of gravity? Then, who knows just what position a four-wheel truck will assume on a curve, and what effect gage widening has on that position? If you don't even know that, how can you make even a wild guess at the position that will be taken by a consolidation locomotive; and how dare you assume that that position will be the same at all speeds? Will the centrifugal action that shifts the center of gravity affect the position? I don't know. Do you?

Now, everybody knows that in rounding a curve one wheel must slip to make up the difference in the length of the rails. Which wheel slips? Is the slip all on one wheel, or is it distributed between the two? Is there any difference in the slip of the front and rear wheels of the same truck? I don't know. Do you?

What is the coefficient of friction between the wheel and the rail when both are worn? Rather, how much will it take to slip a worn wheel laterally? Doesn't it jump up in the air to a point that rather tends to take your breath away? I have been told confidentially that an attempt to measure the matter on a consolidation locomotive running at 10 miles an hour resulted in putting the measuring apparatus out of commission, with a good big margin to spare, and that this didn't happen until a load of 30,000 lbs. had been exceeded. Won't it take more to slip a wheel toward the outside of the rail than in? Anyhow, can you guess what the coefficient of that resistance—whether frictional or something else—may be on a worn wheel? I can't.

How much of this thrust is due to side bearings sticking; how much to engine stiffness, and how much to speed?

Now, with such an array of ignorance before us, what possible basis does a mathematical calculation have to stand upon? It looks like attempting to solve a problem in calculus before the value of the common numerals had been learned. It reminds one of the answer given by a certain superintendent of motive power to a question as to the method he used in calculating the strength of his main rods. He said: "I calculate a little and guess a good deal." From the lessons of past experiments, it looks as if an engine or car rarely behaved twice alike in going around the same curve at the same speed, so that the only thing to do is to take a cut across lots, drop the calculations and measure up the results. We ought to do this often enough to be sure that we have the most destructive effects, and then we ought to act accordingly.

History occasionally repeats itself, and the old invention has a habit of bobbing up serenely as a novelty. I suppose that ever since the first mail bag was dropped from a passing express some one has been scheming to do the same thing with passengers, and inventing ways for picking them up is just as attractive. Cars have sometimes been cut loose from a moving train and allowed to come to a standstill, as in England, and it is not so many years ago that one genius proposed a sort of window-shade affair, in which a coil of rope was to be wound on a drum on a standing car and was to have a projecting loop caught by a hook at the rear of a passing train. The aforesaid drum was to be fitted with a spring, which should be gradually wound up as the rope was paid out, and the resistance to this winding was to start the car and bring it up to train speed. Then the rope was to be wound in, the car coupled to the rear, the passengers transferred to the "car ahead," others for the next stop were to be put in and the car cut off again. This was to be repeated all along the line. Could anything be simpler? But somehow or other the scheme never became popular, probably because of the rope. So now we have another rapid transit car—a "wonderfully simple and very practical invention"—which is, in effect, a car with a number of side doors, attached to the through train. Then there is to be another just like it on a side track. As the express approaches, the side track car starts and runs alongside, and when the doors are exactly opposite, "the cars are to be coupled, the platforms lowered, vestibules fixed and the transfer quickly made," the car cut off, and there you are. We are not informed of the length of side track needed for the transfer at 60 miles an hour, or how the various little details of the arrangement have or have not been worked out. But we are all anxious to put money in it, for we have seen it stated in a reputable paper that "when it becomes generally known that this great improvement in railroading is possible, there will be a universal demand made by the public for its introduction!" The principle is old enough. Away back, fifteen years ago, a newsboy made a practice of transferring from an express to a local on a four-track line, so the paper said, and kept it up until he was stopped. But that boy was a gymnast and had nerve. And now we await the trial trip of the gymnast car.

Colonel Yorke on the Great Western Audible Distant Signal.

The cab signal in use on a section of the Great Western Railway of England, in place of visual distant signals (which have been abandoned) and which was described in the *Railroad Gazette* of November 15, 1907, was the subject recently of a paper by Mr. W. Dawson, read before the Institution of Civil Engineers, and of a discussion following the reading. From this discussion we reprint the remarks of Lieutenant-Colonel H. A. Yorke, Chief Inspector of the British Board of Trade, as reported in the Bulletin of the International Railway Congress:

I think you will all agree with me that this is the most important development of signaling that has been attempted in this country for some years past; and I venture to suggest that the thanks of the community and of the railroad world at large are due to the Great Western Railway, for their enterprise in inaugurating and continuing experiments in this direction. The device under discussion represents the most serious, or at any rate the most continuous, attempt that has been made, as far as I know, to solve the problem of audible signaling on railroads in this country. It has been watched with the greatest interest by the officers of the Board of Trade, and I may say that, through the courtesy of the Great Western Railway, I have been personally kept informed of all the details of apparatus from its inception. I have seen it when it was tried merely in a siding outside the signaling works of the company. I have seen it tried tentatively on the main lines. I have seen it on the Henley branch, and finally on the Fairford branch, where it is now more or less permanently installed. So far as their experience of it goes, the Board of Trade officers have been able to express satisfaction with the results obtained up to the present time. The innovation may seem perhaps somewhat startling to some railroad engineers, the innovation being the substitution of an audible signal for a visible signal, but audible signals are already in existence on railroads in the shape of the detonator, which was introduced in the year 1840, and has done good service since that date. The difference between the appliance now under discussion and the ordinary detonator, seems chiefly to lie in the fact that the audible signal in this case is carried on the engine instead of being placed on the ground, and the driver therefore has the advantage of carrying the signal with him instead of having to hear a momentary explosion. As I understand it, this appliance has resulted from the efforts of railroad companies, and the Great Western Railway Company in particular, to discover some apparatus for fog signaling on railroads as a substitute for the fogmen. The Board of Trade have for many years past been pressing railroad companies to endeavor to seek for some apparatus of this nature. Not that we have any reason to doubt the reliability of our fogmen. I believe our fogmen do their duty in the most devoted manner, and when present on the ground, are quite reliable. I cannot at present call to mind any accident which has been due to the neglect of a fogman when on duty; to his absenting himself from his post; or to his failing to put the detonators on the line when necessary. On the contrary, I believe they constantly expose themselves to danger in carrying out the responsible duty which is put upon them. But the danger of fog arises from its coming on suddenly. At such a time fogmen are not always immediately available to take their posts at the signals to which they are allotted, and then follows a dangerous period. It is to meet that danger that the Board of Trade have always pressed railroad companies to endeavor to find some reliable fogging apparatus. The requirements of a fog-signal are of course well known. It should be absolutely reliable, or at least as reliable as the fogmen are at the present time; it should be always available; it should

give a positive as well as a negative indication; it should be easily understood by a driver; and it should be placed at such a distance from the stop-signal, that the train can be brought to rest before it reaches that signal after the driver has received the communication from the fogging apparatus. It seems to me that the only way in which to ensure compliance with these requirements, is to keep the apparatus in constant use. Unless it is in constant use, it is liable to be neglected, and the maintenance of it might not be sufficiently attended to. Supposing that it were put out of use in the summer months in the anticipation that it was not required, and that fog came on unexpectedly in the autumn, the apparatus would not be available, and difficulty and danger would arise. I have always regarded it as essential that any fogging apparatus, to be reliable, should be in constant and daily use. It is then under the observation of the drivers and the signalmen and all the officers of the company, and then it is known to be at all times available. But if it is always in use, and if it is placed alongside the distant signal (which is the most suitable place for it) it seems that the introduction of such an apparatus means the duplication of the signal, that is to say, there would be an audible signal as well as a visual signal, and such a duplication might be disconcerting to a driver. He would get in the habit of regarding one signal and ignoring the other; he might prefer to observe the audible in preference to the visible, or the visible in preference to the audible; but he would get in the habit of attending only to one. In that case, the second signal becomes superfluous, and might as well be taken away, and it would seem that the one to remove would be, not that which is distinguishable at all times, whether the atmosphere be clear or foggy, but that which is only of service under favorable atmospheric conditions. A signal which is sufficiently reliable for the conducting of traffic during time of fog must, it seems to me, be equally serviceable for use when the atmosphere is clear. If, therefore, we are going to pin our faith to an audible signal in time of fog, why should we hesitate to pin our faith to the same apparatus when the atmosphere is clear? The present apparatus, as I say, arose from the desire of the company to find a suitable fog-signal, but if placed alongside or in substitution of the distant signal, it has a further advantage, inasmuch as it enables a distinction to be made between a distant signal and a stop signal. There has always existed in England an anomaly in signaling, inasmuch as at night-time, the red light is used on distant signals as well as on stop signals. That has never seemed to me to be entirely satisfactory. If such an apparatus as this should be found to be reliable and be introduced into this country, it will enable that difficulty to be overcome, and the distant signal would at all times be easily distinguishable from the stop signal. Mr. Jacomb-Hood suggested that the time is approaching when possibly we might dispense with semaphore or visible signals altogether. I think that is looking rather far ahead. At present I should prefer to see this apparatus tried only in substitution of distant signals. It is doubtful whether it would ever be suitable for stop signals, as these must indicate the exact spot where the driver has to bring his train to rest, and an audible signal on an engine does not meet that requirement. But when all is said and done, the opinion of the drivers is one of the most important factors in all signaling questions, and I suggest that the company should endeavor to arrive at the feeling of the drivers in regard to an audible signal such as this carried on the engine, and to ascertain whether in the driver's opinion it is a better signal, than a fixed signal alongside of the line. There are debating societies among railroad men, and institutes where men can meet, and I think it would be a good thing if the drivers were encouraged to discuss the utility of this apparatus among themselves.

Express Locomotives—State Railroads of Sweden.

The standard express locomotive that has formerly been used on the State Railroads of Sweden has been known as the Class Cc and has rendered very satisfactory service until recently, when the weight of trains has been so increased that it has been very difficult to maintain the schedule without either double heading or using the company's 4-6-0 two-cylinder compounds. The objection to this substitution lay in the fact that these engines had a rated speed limit somewhat below that called for by the express train schedules. Consequently, an Atlantic locomotive was designed by the Bureau of Motive Power Design for the State Railroads at Stockholm in order to meet the increased requirements of the service, which sometimes called for the hauling of 12 sleepers. After considering the relative merits of the four-cylinder balanced compound and the simple engine, the latter was chosen and an order placed with the works of Nydquist & Holm, of Trollhattän, Sweden, for an engine of which the following are some of the principal dimensions:

Cylinder diameter	19¾ in.
Piston stroke	24 "
Driving wheels, diameter	75 "
Steam pressure	170 lbs.
Tubes, ordinary, diameter	2 in.
" superheater, diameter	5½ "
" ordinary, number	141
" superheater, number	18
Tubes, length	23 ft. 8 in.
Heating surface, firebox	126.35 sq. ft.
" " tubes (superheated)	341.04 "
" " tubes	962.88 "
" " total	1,430.87 sq. ft.
Superheater surface	352.88 "
Grate area	27.97 "
Weight on driving wheels	67,980 lbs.
" front truck	40,920 "
" rear truck	23,540 "
" total	132,440 lbs.
Tractive power on basis of 65% of steam pressure...	13,650 "
Tractive power on basis of 85% of steam pressure...	17,850 "

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 3.81$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 7.42$$

$$\frac{\text{Tractive power x diameter drivers}}{\text{Heating surface}} = 934.24$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 51.16$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 8.87^*$$

$$\frac{\text{Weight on drivers}}{\text{Total heating surface}} = 47.59$$

$$\frac{\text{Total weight}}{\text{Total heating surface}} = 92.56$$

Volume of two cylinders = 8.51 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume of 2 cylinders}} = 168.13$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 3.29$$

Tube heating surface equated to firebox heating surface (Vaughan formula), sq. ft. 248.54

Total equated firebox heating surface, sq. ft.....375.49

$$\frac{\text{Total heating surface}}{\text{Equated heating surface}} = 3.81$$

*Per cent.

The two tractive powers are given because, according to the Swedish formula only 65 per cent. of the boiler pressure is used in estimating it. In all the comparisons, however, that calculated on the 85 per cent. basis is used so as to make it comparable with American practice.

The boiler has an internal diameter of 59½ in. and the rather remarkable length between tubesheets of 23 ft. 8 in., an increase beyond even the most advanced practice of the United States. The foundation ring is of cast-steel and rests upon the frame by four lugs. These lugs are of a peculiar shape and are grooved on the sides to take pads having corresponding projections. They are bolted to the frames so that a rigid attachment is secured for the boiler both laterally and vertically and yet it is free to move fore and aft under the influence of its expansion and contraction due to changes of temperature. The only notable feature about the boiler itself is to be found in the fact that the first course is welded instead of being riveted for the longitudinal seam, which was done in order to simplify the connection with the front tubesheet and thus make it easier to secure a tight joint.

The superheater is arranged in accordance with Schmidt's latest design, with its pipes placed in enlarged fire tubes in the upper part of the shell. The steam leaves the boiler in the ordinary manner by way of an enlarged T head which is divided into two chambers in such a way that one of them is in direct communication with the dry pipe and the other with the steam chest of the cylinders. Steam reaches the second chamber from the first by way of eighteen 1¼ superheater pipes placed in the enlarged firetubes. The course is the usual one back toward the firebox, through a return bend and thence to the smokebox, making two round trips through the four pipes, finally reaching the second chamber of the T head and the cylinders in a highly superheated condition. A damper is placed in the smokebox by which the firebox gases may be prevented from passing through the large tubes and coming in contact with the superheater tubes when there is no steam in them, thus avoiding possible overheating. This damper is also so connected with the blower that it is always shut when the latter is in use.

The smokebox is very large, being about 80 in. long, and the old spark extinguisher at the base of the stack is replaced by a mantle of perforated plate set between the exhaust pipe and the base of the smokestack, by which less resistance is offered to the passage of the gases than in the old method.

The grate has a slight slope down to the front; but otherwise is of the standard pattern.

The cab appliances are the same as in the later types of State Railroad locomotives, with a few additions that are only used in the United States for experimental purposes. These include a pyrometer, made by Steinle & Hartung, that is placed in the steam chest and shows, by means of a dial in the cab, the temperature of the superheated steam. There is also a steam gage to indicate the steam chest pressures; an apparatus for cleaning the tubes by steam and a mercury controlling gage.

The steam turret is of comparatively new design and is made in one piece with the throttle stem stuffing box on the back head of the boiler, and will be seen to have a dry pipe connection to the dome. The advantage of this arrangement lies in the small space occupied and the accessibility of the whole to the engineman.

The design of the engine differs in many respects from that of the ordinary European locomotive, and, with the exception of the cylinder location and the crank axle, shows a decided leaning towards American practice. The frames are of the bar type, flattened at the front to a thin slab to give more room for the cylinders and simplify their fastenings.

The cylinders are between the frames and are cast with half saddles and valve chests, are made reversible and interchangeable and are bolted together and to the boiler in the American manner.

The main rods connect to the front driving axle, which, being cranked, is of nickel steel, while the others are of open hearth steel. All the rotating weights are fully balanced in each wheel, and, in addition, 30 per cent. of the reciprocating forces are equally distributed over the driving wheels. The crank pins for the side rods are set diametrically opposite the inside cranks for the main wheels in accordance with the usual practice.

The driving boxes are of a novel design in that they are provided with adjustable side bearings for taking up the side wear, and thus maintain a smooth working engine for a longer time than is possible with the ordinary boxes. The adjustment is effected by means of two vertical bolts with countersunk heads on the top of the box and double nutted beneath the oil cellar, which, in turn, supports the side brass that abuts solidly against the upper brass through an intermediate liner. The truck journal boxes are of the ordinary form but are placed outside the wheels in order to secure better accessibility to springs and bearings, and at the same time give more room between the frames for the cylinders. All boxes, wheel centers and engine and truck frames are of cast-steel.

The pistons are of cast-steel and are supported by an extended piston rod with bearings and stuffing boxes in the front cylinder head. This is in accordance with current practice in Europe, where it has been found that large pistons with three rings, working under highly superheated steam, wear the cylinder unduly unless they are given this support.

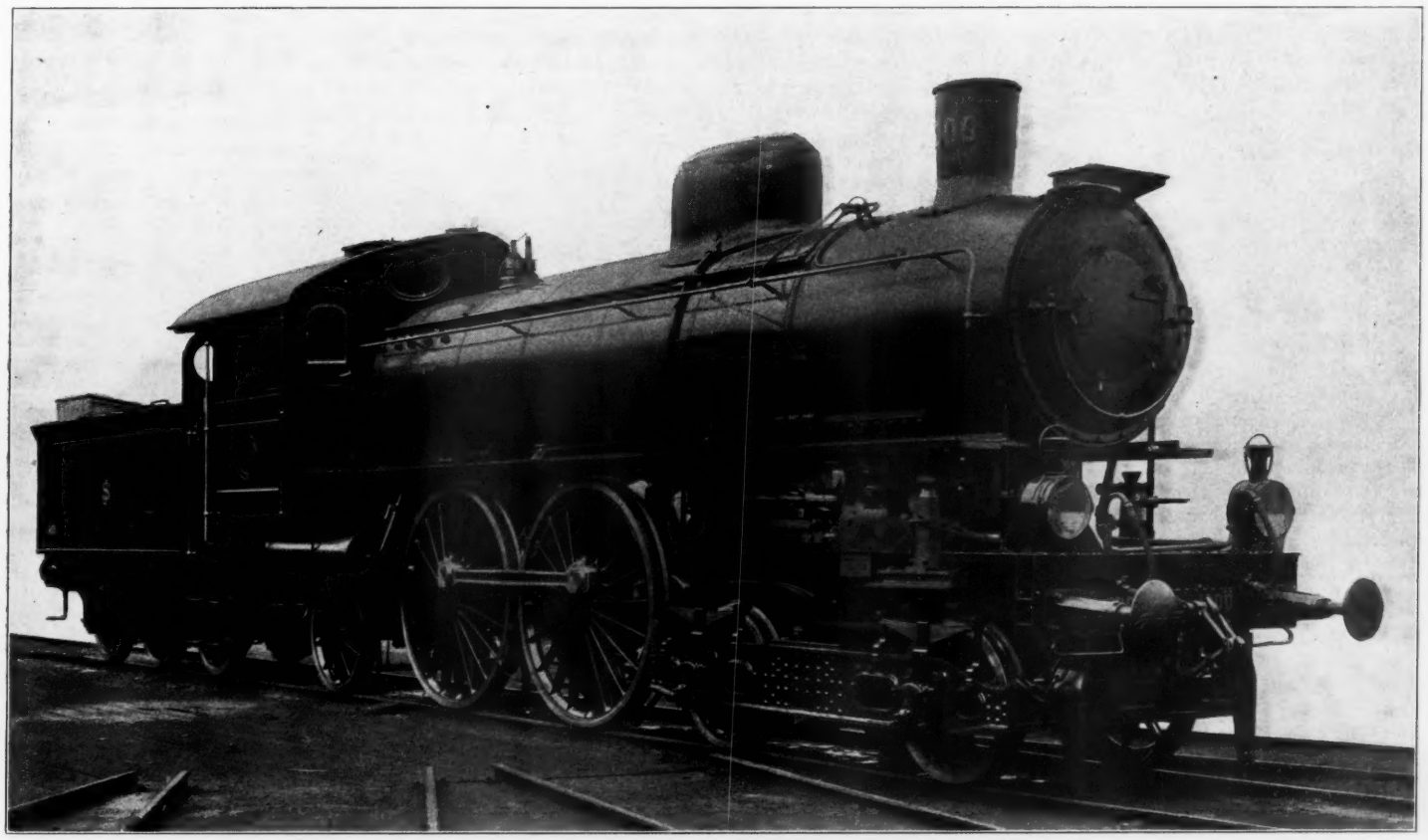
The piston valves were designed by Mr. Carlquista, the designing engineer of the State Railroads, and are operated by the Heusinger von Waldegg, or Walschaerts gear, the usual screw working on the reach rod by means of a hand wheel of European practice being used.

The springs and spring suspension closely resembles that in use on American Atlantic locomotives, though, at the rear driver, the springs are underhung by means of an extension of the jaws of the boxes. This effects the three-point suspension system, where the truck carries the front end on a swiveling or swinging center bearing and the driving and trailing wheels are equalized together on each side of the engine. Further than this; especial attention was paid to so proportioning the springs that a soft and easy motion will be secured.

Single bar guides are used because of the lack of room for a lower one.

The cab is of wood, instead of plate, for the purpose of avoiding the slamming noise that is apt to occur at high speeds with a metal construction. It is provided with a wind-splitting front so as to reduce the atmospheric resistances.

As the machine is built for high speeds, equalized brakes are applied to all the wheels, including those of the truck. Those on the drivers and trailers are worked by a vacuum cylinder at the rear of the engine while those on the truck are operated by a separate cylinder connected to the same suction pipe and vacuum receiver but capable of being cut in or out at will. The brake valve is so arranged that only the train brake is applied by a partial movement of the handle, as a normal condition of operation. But, for the requirements of a quick stop, a further movement of the handle brings the locomotive brakes into action also. The brake-shoes are attached to the head by a key which facilitates replacements when they are required. The vacuum ejectors discharge the steam to the atmosphere through a muffler on top of the cab so as to avoid the usual long discharge pipe leading to the stack.



New Express Locomotive for the Swedish State Railroads.

The engine is provided with a speed recorder of Haussbalter's latest design, indicating the speed at three-second intervals. Lubrication of the valves and pistons is obtained by means of a Michalk's oil compressor, driven by an eccentric pin on one of the trailing wheels, thus forcing the oil to place, a provision that has been found to be necessary when using superheated steam.

At present the tender is of the standard type used on the old passenger locomotives, because the existing turntables are not large enough to accommodate a longer wheel base than these call for; but, as soon as the contemplated changes in turntables have been made, a larger tender will be used. Several runs were made with the new engine in order to obtain a comparison of its performance with the old Class Cc, or eight-wheelers. Two weights of trains were taken, one having a weight equal to the maximum load of the smaller Class Cc engines, and the other one suited to the new locomotive. These heavier trains were hauled with the Cc engines double heading and the fuel consumption compared with that of the single superheater engine doing the same work.

The tests were run between Malmö and Nasijo, a distance of 167

miles, giving the following results for three trips with the light trains:

Engine.	Train weight, net tons: Excluding engine & tender.	Train weight, net tons: Including engine & tender.	Consumption: Coal, lbs.	Consumption: Water, gals.	Saving effected by superheater: Coal, lbs.	Saving effected by superheater: Water, gals.
Superheater	231.0	333.3	7,590	5,839	5,390	2,140
Cc	225.5	310.8	12,980	7,979	.....	.....
Superheater	258.5	360.8	5,610	4,465	3,300	978
Cc.	253.0	333.3	8,910	5,443	.....	.....
Superheater	242.0	344.6	6,930	5,522	5,940	2,325
Cc.	242.0	322.3	12,870	7,847	.....	.....

According to this comparison based on ton-miles, the new engine consumed 46.5 per cent. less fuel and 21.5 per cent. less water than the Class Cc.

In a trial with the heavier trains weighing 400 net tons without engines and tenders, which were run as specials, over the same track, making one round trip with the superheater engine and one with the Class Cc double-headed, the schedule was laid out for an average speed of 34 miles an hour, but, owing to delays, considerable lost time was made up by both trains so that the actual average speed with the superheater engine was 42 miles an hour, and that with the Class Cc, 39 miles an hour. The maximum observed speed with the former was 65 miles and with the latter 62 miles an hour.

The coal consumption per 1,000 ton-miles, weight of engine and tender included, was 113.29 lbs. for the locomotive with the superheater, and 211.78 lbs. for the smaller engines, showing a saving of 46.6 per cent. in coal and 49.5 per cent. in water.

It will be noticed, of course, that the light engines were at a disadvantage with their comparatively small boilers, short tubes and restricted grate area, so that they had to be forced to maintain speed and burned 116.5 lbs. per sq. ft. of grate per hour as compared with 84.7 lbs. in the superheater engine. Further than this, it should be borne in mind that only about 80 per cent. of the tractive power of each engine is utilized at the drawbar of the second engine. So that comparisons from an engineering point of view are weak, though when considered from that of the traffic department it can readily be shown that a considerable saving can be effected with the new type of engine.

The highest power developed by the superheater engine was 1,095 h.p., and was done at 48 miles an hour with a 40 per cent. cut-off.

The temperature of the superheated steam averaged about 454 deg. Fahr., though on two occasions it rose to 490 deg. Fahr., or a maximum superheat of about 180 deg. Fahr.

The illustration shows the curves of the drawbar pull of the two classes of engines at various speeds and also the train resistances, exclusive of engine and tender, for three trains consisting of 12, 10 and seven bogie sleeping cars respectively. They show that the locomotive with superheater can haul a train of 333 net tons, that is to say, locomotive, tender and seven cars, at a speed of 31 miles per hour on a continuous 1 per cent. grade or 64 miles per hour on a level, while the speed of the lighter engine will be limited to 17 and 56 miles an hour respectively.

In the case of a 10-car train the superheater engine can haul it up the 1 per cent. grade at 22 miles an hour and over a level at 58 miles an hour, while the light engine cannot take it up the grade at all. Finally the superheater locomotive can haul a 12-car train up a 1 per cent. grade at 17 miles an hour and over a level at 52 miles per hour.

These curves are based upon the assumption that the superheater engine can evaporate 9.5 lbs. of water per sq. ft. of heating surface per hour and that the Class Cc engines will evaporate 10.8 lbs., although it has been found that this latter figure can be exceeded by forcing the fire.

An endurance test was run with the superheater engine from Malmö to Katrineholm and return, a distance of 300 miles in each direction, changing crews midway on each trip, when it was found that the engine could make the run in ordinary express service with no appreciable loss of steaming qualities at the end. This is naturally regarded as of great importance from an economic standpoint as it will make it possible to greatly reduce the number of engines required for the service. The results of these tests were so satisfactory in every respect, including ease of motion, accessibility of working parts as well as economy of operation, that 10 more were ordered of the same design.

Consumption of Pulpwood in 1906.*

The chief features of the year 1906 in connection with the manufacture of wood-pulp were:

(1) A consumption of wood greater by 469,053 cords than that of any previous year.

(2) The highest average value per cord for all kinds of wood.

(3) An increase of 93,000 cords in the imports of pulpwood. Of the two woods imported—spruce and poplar—spruce alone showed an increase—poplar decreased by over 5,000 cords.

(4) Since 1899 the amount of wood consumed each year for pulp has increased, in round numbers, from two million cords to 3½ million cords.

In 1906 the consumption of wood for pulp exceeded the high-water mark of 3,192,123 cords reached in 1905 by nearly one-half million cords, making the total consumption, by 250 mills, 3,661,176 cords. The year showed a heavy increase in the consumption of hemlock wood. Except balsam, the consumption of which fell off by nearly 23,000 cords, or 40 per cent., all other kinds of timber show a normal increase in quantities consumed. The increase for poplar was less than for any of the others, and its consumption remained nearly stationary.

The following table shows the quantity of wood of different kinds used for the manufacture of pulp in 1899, 1905 and 1906.

Kinds and Amounts of Wood Manufactured into Pulp.

Kind.	Quantity, cords. 1899.	1905.	1906.	Per cent. of inc. (+), or dec. (—): 1899 to 1905.	1905 to 1906.
Spruce	1,509,202	2,273,254	2,507,002	+ 50.6	+ 10.3
Poplar	256,953	322,058	328,470	+ 25.3	+ 2.0
Hemlock	.....*	375,422	528,381	.....	+ 40.7
Pine	.....*	57,399	69,277	.....	+ 20.7
Balsam	.....*	56,744	33,886	.....	— 40.3
Cottonwood	.....*	10,507	.....	.....	.....
All other	220,155	96,739	194,160	—56.1	+100.7
Total	1,986,310	3,192,123	3,661,176	+ 60.7	+ 14.7

*Included in "All other."

In both the consumption of wood and manufacture of pulp New York has ranked first from the earliest time of which there is record. In 1906 New York alone consumed 1,295,904 cords, or more than twice as much as Maine, which ranks next, with 617,743 cords. Wisconsin ranks third, with 542,354 cords. New Hampshire follows, with 319,729, Pennsylvania with 282,973, and Michigan with 115,272 cords. No other state consumed as much as 100,000 cords. It is interesting that the consumption of New York shows a small decrease from the 1905 figures, while Maine, Wisconsin, Pennsylvania and New Hampshire have all increased their consumption. It should be borne in mind in connection with these figures that in practically no case is all the wood produced in the same state in which it is consumed. In New York, for example, the report of the state forest, fish and game commission shows a cut of 516,778 cords of pulpwood in 1906, or approximately 40 per cent. of the amount of wood used by the pulp mills of the state.

The following table summarizes by states the quantity and value of wood used for pulp and the amount of pulp produced during the years 1905 and 1906.

Wood Used for Pulp in 1905 and 1906.

State.	1906: Amount, cords.	1906: Value.	Average price per co at mill.	Estimated quantity pulp produced, tons.	1905: Amount, cords.	1905: Value.	Average price per cord (at shipping point.)	Estimated quantity pulp produced tons.
Maine	617,743	$4,575,100	$7.41	383,535	501,807	$2,950,625	$5.88	323,012
Massachusetts	33,302	262,030	7.87	18,086	34,362	171,810	5.00	16,995
Michigan	115,272	663,055	5.74	57,099	109,764	475,278	4.33	63,275
Minnesota	31,848	191,833	6.02	25,406	31,802	121,801	3.83	24,742
New Hampshire	319,729	2,364,270	7.39	174,543	233,700	1,257,306	5.38	128,898
New York	1,295,904	10,351,247	7.99	945,379	1,301,986	8,137,412	6.25	977,313
Ohio	34,723	189,011	5.44	16,868	54,000	274,320	5.08	29,050
Oregon	72,174	373,591	5.18	49,304	.....	.....	.....	.....
Pennsylvania	282,973	1,583,117	5.59	127,356	250,826	1,158,816	4.62	123,372
Vermont	34,968	290,384	8.30	38,403	22,271	122,490	5.50	20,207
Virginia	81,764	621,002	7.60	43,902	89,540	492,470	5.50	44,649
West Virginia	61,736	383,687	6.21	33,577	96,357	497,202	5.16	49,857
Wisconsin	542,354	3,708,540	6.84	338,997	382,471	1,686,697	4.41	240,657
Others	136,686	855,020	6.26	75,389	83,337	389,438	4.67	42,455
Total	3,661,176	$26,411,887	$7.21	2,327,844	3,192,223	$17,735,665	$5.56	2,084,482

New York led in both 1905 and 1906. In 1906 Maine ranked second, Wisconsin third, New Hampshire fourth and Pennsylvania fifth. In 1905, however, Pennsylvania ranked fourth and New Hampshire fifth, a reverse of the order of 1906. All of the wood imported into the United States for the manufacture of pulp comes from Canada and is free from duty. The amount has increased from 369,217 cords in 1899 and 622,545 cords in 1905 to 738,872 cords in 1906.

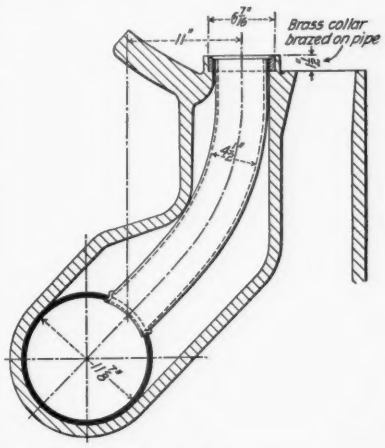
*Abstract of a report of the Forest Service, issued Nov. 26, 1907.

A Method of Repairing Cracked Piston Valve Cylinders.

BY B. P. FLORY,
Mechanical Engineer, Central of New Jersey.

Most roads that use locomotives with piston valves built several years ago have been troubled more or less with cracked cylinder castings. These cracks usually form in the walls of the piston valve chamber and it is very hard to patch them so that they do not leak.

The Central of New Jersey has a large number of piston valve engines and quite a few of these have cracked cylinders. On some classes of engines these cracks run vertically around the valve chamber, and on others they extend longitudinally. Just what causes these cracks has not been determined. One explanation is that the relief valve let cold air into the valve chamber while the engine was drifting. Another reason that may be advanced is that the cylinders may not have their metal distributed properly to take care of shrinkage strains.

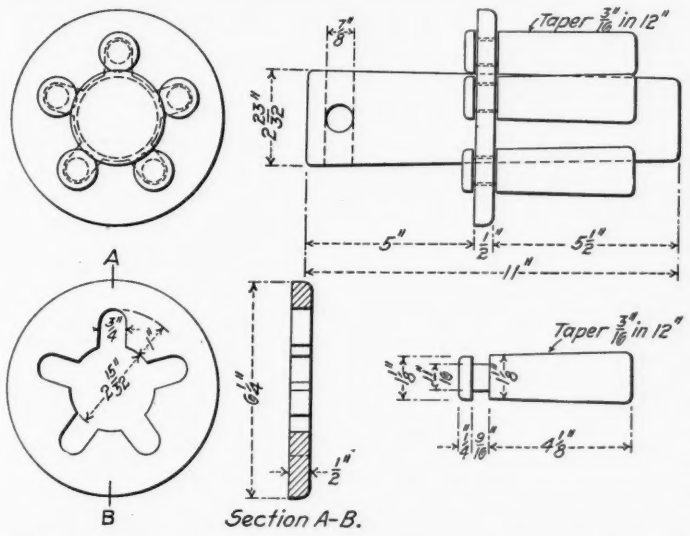


Bushing and Supplementary Steam Pipe for Repairing Cracked Piston Valve Cylinders.

To renew a pair of cylinders is quite expensive, and various methods of patching have been tried, but none seem to have been successful. Plugging up the relief valve opening in the valve chamber and putting the relief valve in the cylinder port in the saddle did some good, but still there were a few that cracked. Therefore it was found necessary to either replace the cracked cylinders or find some other method of repairing them.

The following method has lately been adopted: The valve chamber is bored out to as large a diameter as possible without weakening the walls, and a solid bushing is put in. A supplementary steam pipe is then run from the steam pipe proper through the steam passage into a hole in the side in the valve chamber bushing. This supplementary steam pipe is made of wrought iron and is beaded into the bushing by the tube expander shown by the accompanying drawing. The other drawing is a cross-section of the piston valve chamber fitted with the bushing and the supplementary steam pipe.

On one class of engine we were able to use some extra heavy 12-in. pipe for the bushing and use the same size valve. On another



Tube Expander for Beading Supplementary Steam Pipe Into Bushing.

type, however, a heavy freight engine, it was necessary to put in a new valve 10¼ in. in diameter, while the original valve was 12 in. diameter. It was also necessary to provide another place for the relief valve, so a pipe was tapped into the T head and the relief valve attached to the pipe outside of the smoke box. Because of the reduction of the area in the steam port, due to the use of the pipe, it was thought that, perhaps, the amount of steam passing through would not be sufficient, and so an indicator test was made to determine this.

The test was made on the engine that had the valve reduced to 10¼ in., in comparison with another engine of the same class fitted with the original valve and cylinders without the supplementary steam pipe. The train was made up of all-steel coal cars to insure uniformity of loading. No difference could be noticed in boiler pressure and admission pressure on the two engines with the throttle open. The cards showed that the engine with the smaller valve had a slightly higher back pressure and a slightly more rapid drop along the steam admission line. The coal and water tests showed that with the same weight of train there was almost no difference in their consumption. The heavy freight trains on the Central of New Jersey are not loaded to the maximum hauling capacity of the engine. The train load is that which experience has proven best for getting the greatest tonnage over a division in a given time. On a road where the train load is based on the maximum hauling capacity of the engine, the reduction in area of the steam pipe may necessitate a slight reduction in this train load.

The cost for fitting up a pair of cylinders as above described is about $90; the cost of a new pair of cylinders and the labor of installing them is $700. This method was devised by William McIntosh, Superintendent of Motive Power, assisted by G. L. Van Doren, Superintendent of Shops, and the writer.

Signaling of the East River Tunnels, New York.

Though the signaling arrangements for the recently completed tunnel under the East river between Bowling Green, Manhattan, and Borough Hall, Brooklyn, are on the same general principles as those followed in the New York subway, there are a number of interesting variations from the previous practice. In this as in the previous installation, the distinguishing feature is the use of an alternating track circuit for the operation of the relays by means of which the electro-pneumatic apparatus is controlled, while the rails act as returns for the current. It was shown by experiment before the installation in the New York subway was made that an alternating track circuit could be successfully used with a high-voltage direct-current return-power circuit provided that the return-power circuit was carried through only one rail and that the other rail was insulated at the ends of blocks. This principle controlled on the previous and on the present installation.

This extension of the subway system of Greater New York consists of a double tube under the East river connecting with the Manhattan lines at Bowling Green, beyond which the Manhattan lines terminate in a loop. It runs to Borough Hall in Brooklyn at the present time, though construction work has already been completed as far as Hoyt street, Brooklyn, and the continuance of the line to Atlantic avenue is in progress. The present account, however, deals only with the line between Bowling Green and Borough Hall, a distance of about 8,000 ft. This section is of especial interest, since for the greater part of the distance the tunnel lies under the waters of the East river and has grades much heavier than found in ordinary subways.

The new tunnel line, like the Manhattan subways, is operated by the Interborough Rapid Transit Company, though it is owned by the city.

Eighteen signals are included in this section, of which 14 are in the "tubes"—by which is meant the under-river portion in distinction from that part which is under land only on either side. The tubes are wholly separate and the signaling of each is to a great extent a separate proposition, except so far as current supply is concerned. Alternating current at 550 volts is carried in mains each consisting of two No. 2 wires in each tube, from the sub-station in Brooklyn. These are carried overhead in the tunnels in iron pipe to avoid disturbance by dampness. This voltage is transformed twice, reducing the voltage to 10 or 12 volts, the transformers being fixed on columns in the subway outside of the tubes and on the outer walls in the tubes. At Borough Hall station the cables are carried across overhead to avoid dampness and deterioration from oil. An extra set of alternating current mains is carried through the tubes for use in emergency. Air for the operation of switches and the automatic stops is taken from compressors situated at City Hall, New York, and in the Brooklyn sub-station. It is conveyed from the sub-station to the pipes by two 3-in. mains. These have expansion joints about 1,000 ft. apart. The compressors are of Ingersoll-Rand manufacture. There is also a small compressor under the Borough Hall station for use in case of emergency.

The principal compressors maintain a pressure in the pipes of 75 lbs. to 80 lbs. They are driven by Westinghouse type S-10 direct-connected motors. The compressors are of the straight tandem-compound single-acting type, having a capacity for compressing 240 ft. of atmospheric air at 120 r.p.m. Between the high-pressure and low-pressure cylinders is an intercooler. The cylinders have diameters of 12¼ and 19¼ in. respectively and a stroke of 12 in. Each is provided with an automatic starting and stopping device governed by the pressure, which operates to start at 80 lbs. and to stop at 90 lbs.

From the nature of the location lights only are used for signal indications. The signals differ from those in the New York subway. They are similar in respect to color indications, green being used

for clear, yellow for caution and red for stop. In the New York subway the bull's-eye lenses are of clear glass, and in the front of them are placed two four-candle-power incandescent lamps so connected that light is maintained in one if the other is out of order. The color indication is given by means of colored glasses mounted in slides which are raised by rods working in air cylinders in the base of the signal box, and lowered by counterweights. In the tunnel installation this arrangement is done away with. No movement takes place within the signal box. There are separate lenses and a separate set of lamps for each color. As the relay is picked up the lights behind the green lens are turned on, and when it is dropped the red or the yellow is displayed according to whether the signal is home or distant.

In the tubes (where there are no columns) the various parts of the signal apparatus are arranged along the right-hand wall in separate boxes, as shown in one of the accompanying illustrations. They are conveniently reached by maintainers from the shelf forming the top of the enclosure containing the conduits and a hand rail is provided at each signal as a measure of safety. The apparatus consists, in addition to the signal box, of a transformer to which current is brought from the alternating-current main overhead, a resistance box for preventing the short-circuiting of the alternating-current relay, a relay box with impedance coil and a box containing the valves for the operation of the automatic stop. Current for the operation of these is furnished from storage batteries, situated at Bowling Green and Borough Hall stations, which are charged by direct-current motor generators furnishing current at 16 volts and taking power from the third rail.

An interesting detail in connection with the signal boxes fixed on the columns outside the tubes is the provision of a solid block of concrete in the form of a step, in place of the usual ladder. This affords an easy foothold and is free from any possible objection in the way of short-circuiting. Along similar lines and as indicating the care which has been taken in working out the details of the installation may be mentioned the use of asbestos-wood guards along the third rail opposite the signal apparatus and the enclosing of all track instruments with a covering of the same material. (See Fig. 5.) The utmost care has everywhere been taken to guard against the possibility of fire. At Borough Hall station most of the switches now in use are temporary, being required for terminal purposes for which there will be no occasion when the line is extended further; but on all permanent switches the valves are insulated from pipes and from the third rail.

The automatic stop apparatus is the same as that in use on the Manhattan section of the subway. It consists of a rod extending across under the rails opposite each signal and having an arm or trip on the end next to the third rail. In a cast-iron box between the rails are contained an air cylinder, an electro-pneumatic controlling valve and a counterweight on the end of an arm attached to the rod. When the signal stands to indicate stop the air in the cylinder is cut off by a circuit-breaker connected with the signal.

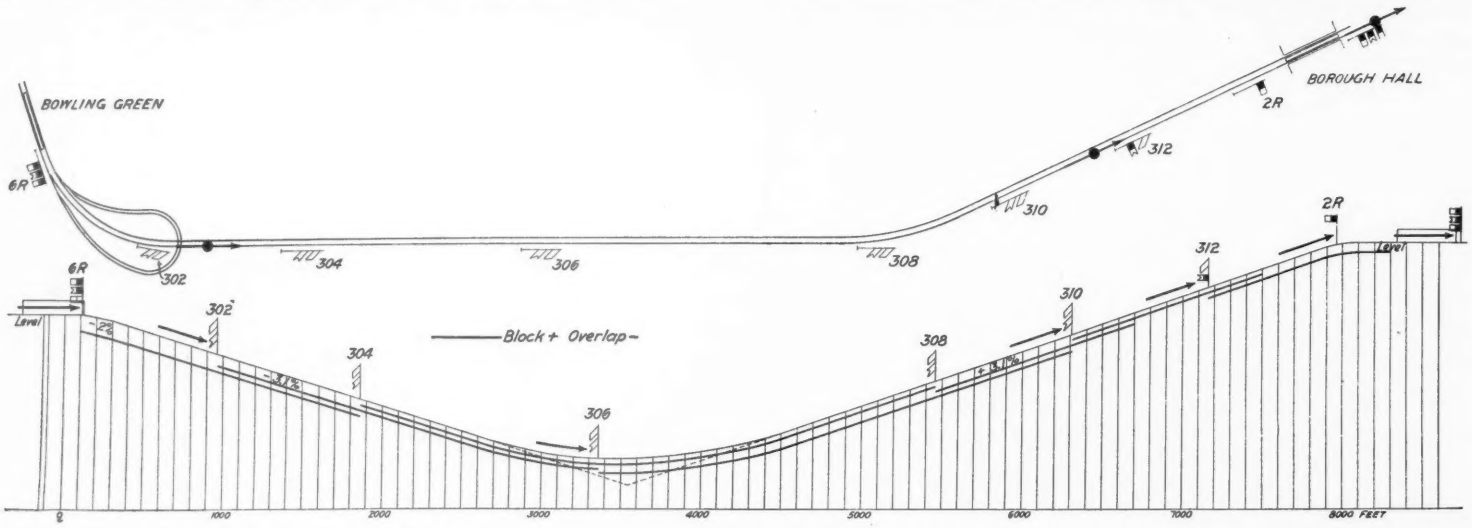


Fig. 1—Signals and Overlaps, Eastbound Track.

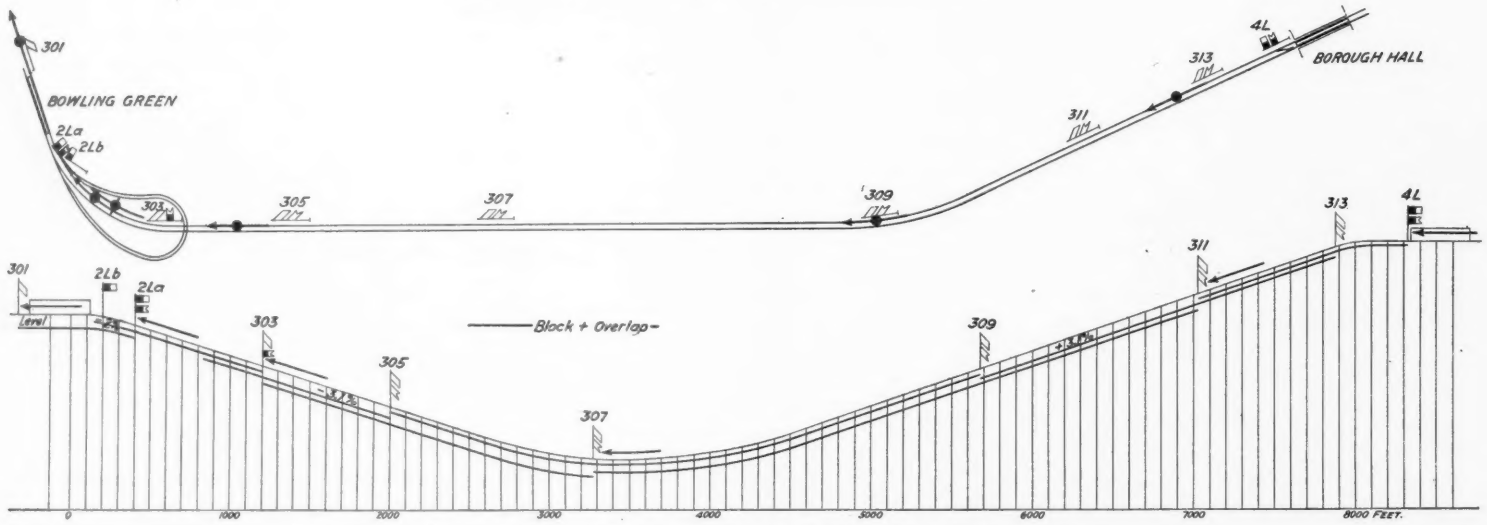


Fig. 2—Signals and Overlaps, Westbound Track.

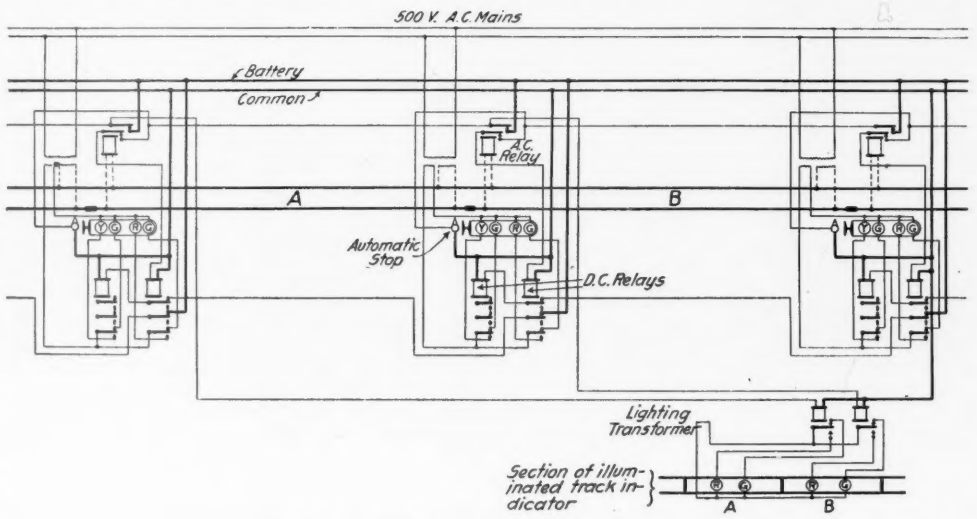


Fig. 3—Typical Block Signal Circuits.

The counter-weight drops and throws the trip arm to an upright position projecting it above the level of the rail. The trucks of all cars are provided with an arm which is connected with a valve in the air-brake train-pipe, and this arm, in case of a train running past a signal set at stop, engages with the trip. The valve in the train-pipe is opened and the brakes are set so as to stop the train before it enters the second block ahead. In order to provide against unnecessary delays to traffic, trainmen are furnished with a socket key by which the air valve may be turned in case of any derangement of the stop.

The location of the signals has been determined by a careful consideration of grades, time-interval and speed of trains. The

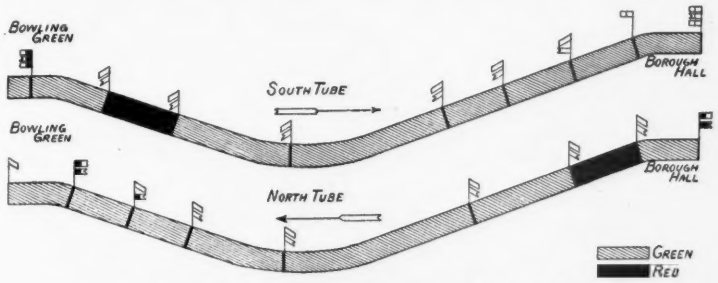


Fig. 4—Sketch of Illuminated Track Indicator.

grade each side from the lowest point is 3.1 per cent., the length of the incline on the Brooklyn side being nearly 50 per cent. greater than on the New York side. Full-block overlaps are provided giving two clear blocks in advance of each train, and they vary in length from 800 ft. to 2,400 ft., as shown upon the accompanying engravings. Circuits are so arranged as to make it possible to run trains in either direction on either track, thus providing for single-track operation in case of emergency or when track work is going on.

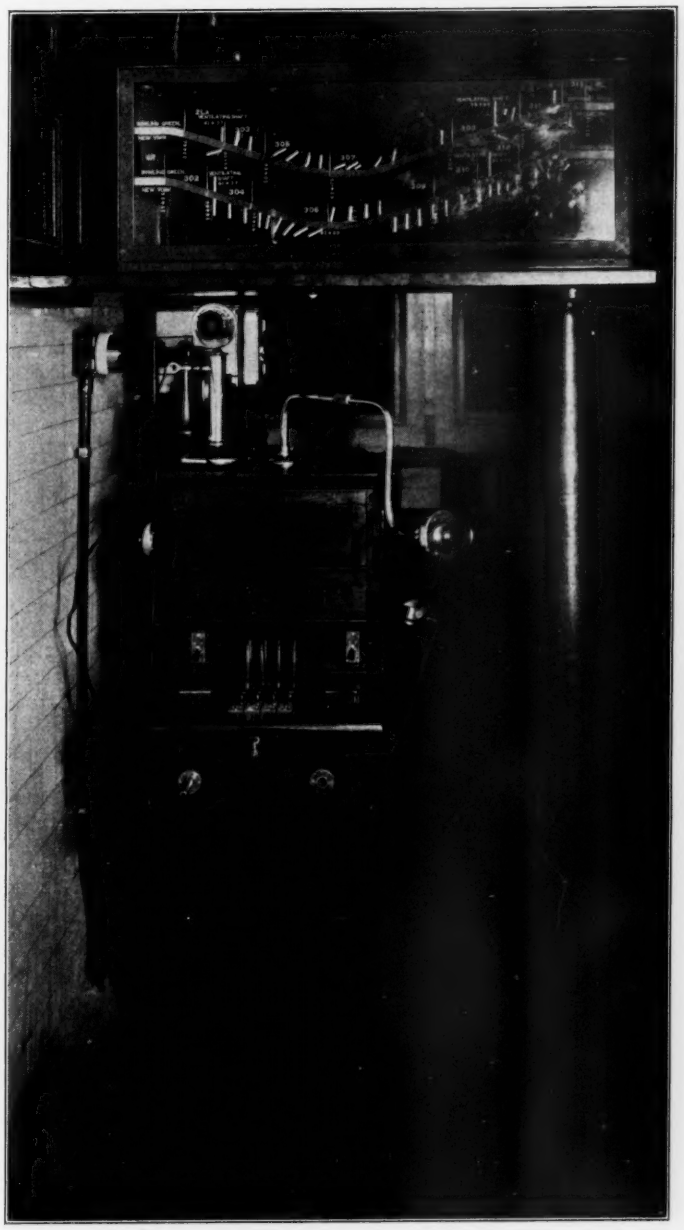


Fig. 6—Track Indicator.

They are so arranged as to make it impossible to admit trains from opposite directions at the same time. Assuming that the south tube is to be used alone, the operator at Borough Hall, having assured himself of a clear track, gives a signal to the operator at Bowling Green and one train may be admitted to the south tube from the Brooklyn end—a reversal of the traffic; and after it is once admitted the signals admitting to the tube are locked beyond control of the operator at Bowling Green. In case of an accident to the train from Borough Hall, and the fact is communicated to Bowling Green

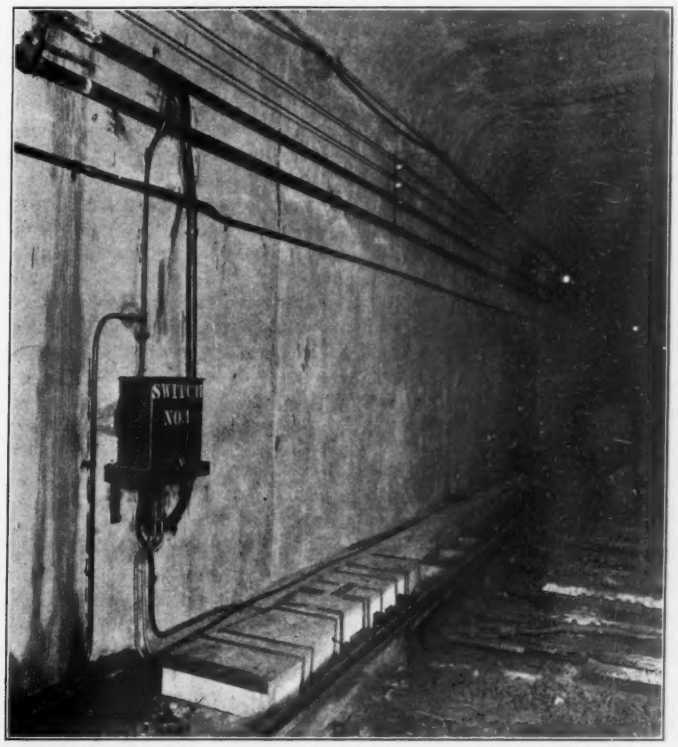


Fig. 5—Fire-Proof Fixtures at Switches.

by telephone, the operator at the latter point can tie up the line at Borough Hall so that no other train can be admitted to the tube from the Brooklyn end.

In the signal cabin at Bowling Green there is an illuminated track indicator, illustrated in the accompanying engravings. Primarily, the indicator consists of a case with a glass front on which are shown representations of the two tubes divided into blocks corresponding in proportionate length to the actual blocks. All of the glass except the representations of the longitudinal sections of the tubes is painted and made opaque. The tube sections normally appear green (clear of trains) and are illuminated by incandescent lamps within the case. A relay at each signal is connected up with the lamps in the indicator circuits in such a manner as to change the color of the space on the indicator representing a block from

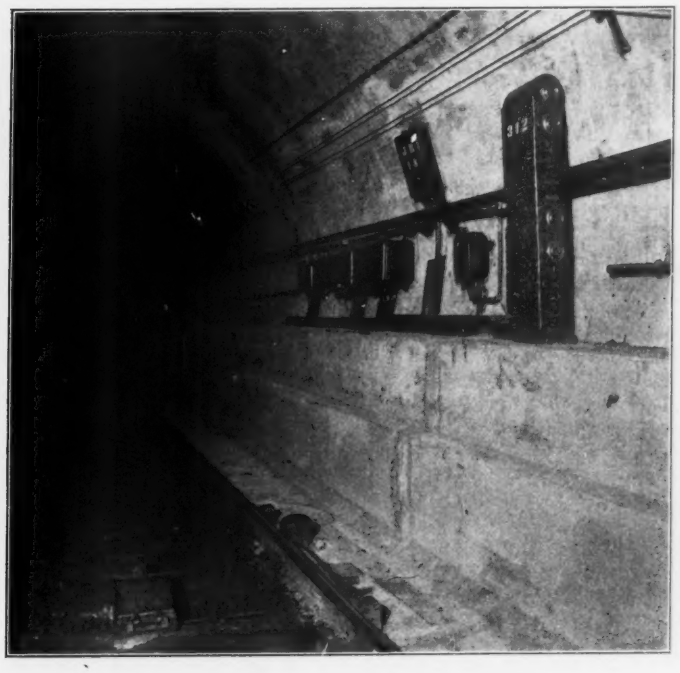


Fig. 7—Signal No. 312 and Accessories.

green to red upon the entrance of a train to that block. The position of every train in either or both tubes is thus clearly shown at all times to the operator at Bowling Green. As a further measure of safety a telephone connection is provided at every manhole in each tube by means of which trainmen may communicate with the operating tower. These connections are available about every 400 ft. throughout the length of the tubes.

The lower story of the Bowling Green cabin contains the junction boxes and the relays for operating the illuminated indicator, and in the maintainer's quarters nearby are kept the storage batteries and the motor generator set for operating electro-pneumatic valves, etc. The maintainer's quarters are fitted up with lockers, etc., in the neatest possible manner. The primary motor generators have compound wound motors and shunt wound generators, and are designed for a range of from 400 to 700 volts. The generator at the Borough Hall station is somewhat larger on account of the larger storage batteries. The latter are larger than required but were on hand and therefore were utilized.

The equipment of the sub-station at Brooklyn includes two oil-cooled transformers designed to operate either at 25 cycles for the third rail rotary transformers or at 60 cycles for the light circuit.

Electric detection is used on switches in place of detector bars.

All cables are of Okonite or of Standard make. As in the case of the Manhattan subway, the apparatus throughout was furnished by the Union Switch & Signal Company and is largely from designs of its engineers. The installation was in charge of J. M. Waldron, Signal Engineer of the Interborough Rapid Transit Company.

Boring Multiple Cylinders.

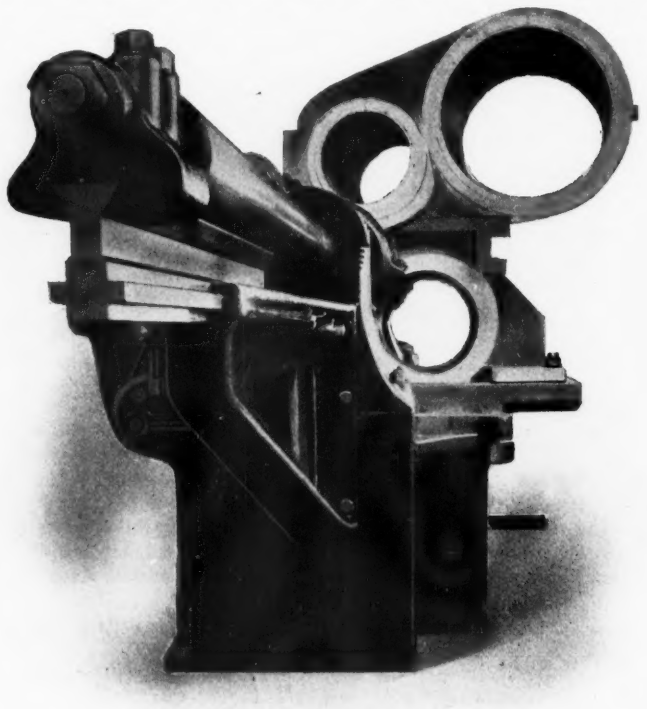
BY E. J. M'KERNAN,
Tool Expert; Atchison, Topeka & Santa Fe.

The usual locomotive cylinder boring machine consists of a horizontal spindle and table permitting of no adjustment at all or of only lateral adjustment. With these machines of the old design much time is consumed in properly setting the cylinder so that the boring bar will strike the true center; and high speeds and rapid cutting are not obtained. These disadvantages are, of course, magnified when cylinder castings having two or more cylindrical chambers are to be bored and faced, because the work has to be set twice, and the cylinders and valve chambers (where piston valves are used) must be truly parallel with each other. If the cylinders should be out of parallel the working of the engine will throw great strain upon the guides, with consequent detrimental effect on the locomotive machinery, causing undue wear, strain and trouble.

The machine of the old single bar type, designed when simple slide valve cylinders of not more than 18 in. or 20 in. diameter were the prevailing type on locomotives, were adapted for use with the slow speed carbon steel which was the most efficient material for making cutting tools at that time. The mechanism of these old machines was simple, but the driving and feed gears were weak cast-iron affairs which drove the tool along at an unprofitably slow speed. Later as the art of cutting materials was on a more scientific basis, and tool steels of greater cutting capacity and speed were introduced in shop practice, attempts to work these new cutting tools to their proper limits in boring machines of this class would result in stripping the gears or other injury to the machine.

With the latter developments in high-speed cutting tools of great capacity, and in locomotive construction, with engines having piston valves and often compound cylinders on the Vauclain principle or on the four-cylinder balanced compound principle, a machine capable of the most effective service under the latter conditions becomes a shop necessity. In order to meet this demand, one manufacturer produced a three-spindle machine which would require but one setting of the work and which would insure the parallel boring of all cylinders and chambers. While this type of machine possesses a number of advantages for certain classes of work, the single bar machine has been found superior for general railroad practice. A comparison of the two types of machines shows that the single bar has less gearing and is the simpler machine of the two and is consequently much easier maintained. On account of the lesser number of parts, the single bar machine is the more economical to drive, hence the power required can be obtained from a small motor. Where there are some advantages in boring three chambers at once it has been found in practice that chatter in one tool is transmitted to the other tools, causing a rough finish in all bores. It is apparent that this is entirely obviated in the single bar machine. From experience in the ordinary railroad shop it has been found that the single bar machine is best suited to locomotive work. It is economical in operation, in power consumed and in adjustments, and owing to the fact that less machinery is involved the single bar machine is the most economical to buy.

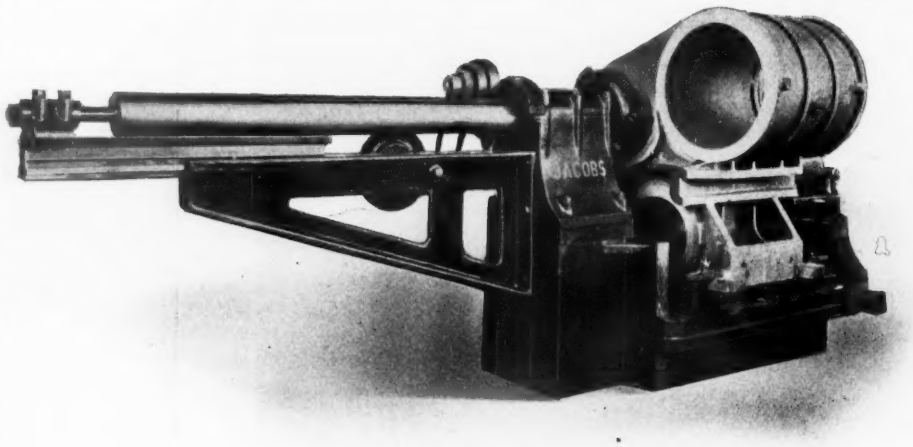
There have recently been built several heavy and solid single bar machines, with the boring bars capable of the heaviest strains, and of such a design as to insure working the cutting tools to the very highest capacity. The accurate setting of the work, especially in connection with multiple cylinders, is brought about by the application of a table having both lateral and vertical motion, and these



Boring Non-Parallel Cylinder Chambers.

machines produce very excellent work. But the examples thus far constructed are heavy, ponderous affairs, costing a great deal for the weight of metal in them alone, and they do not have the universally wide range for accommodating all classes of locomotive cylinder boring that should be a requisite in modern machines for this purpose. Their first cost is high, and the best results are not always obtained from them, not to speak of the relative large amount of shop room required.

At the Topeka shops of the Santa Fe there has been built a cylinder boring mill which will answer all requirements in boring cylinders for all classes of compound engines. This machine is also adapted to bore cylinders on engines which have one cylinder



Single Bar Cylinder Boring Machine.

or chamber at an angle to the others. All cylinders or chambers may be bored at one clamping of the cylinder, by merely raising or lowering the table. This table has an elevating movement of 37 in. and a cross travel of 35 in. The table, which has the cross travel movement, has also a swiveling motion by which a range of 15 deg. incline may be had. (Fig. 1.)

This new boring mill is direct motor driven. The table is raised or lowered by power connection with the main motor through beveled gears and clutches, handled from the operator's side of the machine. All the mechanism is of the latest design and is strong

and durable, all gears being made from good gray iron, all bushings of phosphor bronze; the boring bar is 7 in. in diameter and is made from open hearth steel, and is fed through the cylinder by means of a spur gear and rack which makes it very rigid in operation and gives a very smooth bore.

One of the facing heads on the machine is made so that it will move along on the bar and is driven by means of a 1-in. key and set screw, and will pull any kind of a cut that is put on the machine.

The facing heads are fed by means of a star feed attachment. The screws that elevate the table are made from soft steel and are 5½ in. in diameter and are three-quarters pitch, the screws set at right angles to the boring bar, making everything rigid. The total weight is about 15 tons, and the machine takes up floor space of 223 sq. ft., having an extreme length of 21 ft. and an overall range in width of 14 ft.

This machine is capable of boring a three chamber compound cylinder in 15 hours, or in a year of 3,000 working hours it can bore 200 three chamber compound cylinders. It can also bore a simple cylinder in three hours, or 1,000 in a year of 3,000 working hours.

On the old style boring mill it has taken from 26 to 28 hours to bore a three chamber compound cylinder. It will be noted that by the use of a modern boring mill of this kind 11 hours can be saved on each three chamber compound cylinder, where it used to take from eight to ten hours to bore a simple cylinder. One of these cylinders can now be bored in three hours on this machine, thus making a saving of five hours on each simple cylinder bored, or over $1,500 per year in operator's wages alone, in addition to increasing the machine capacity from only 375 cylinders per year to 1,000 simple cylinders, giving an output of 625 more cylinders per year. Where only 115 three chamber compound cylinders could be handled with the old style boring mill the new machine will bore 200 cylinders, thus increasing the output of compound cylinders about 77 per cent.

If a machine which bores only one chamber of a locomotive cylinder casting at one time is to compete successfully with one which can bore three chambers simultaneously it must not only bore rapidly, but it must be so made that only one setting will be required to bring the chambers into position to bore. This arrangement has been attained in the machine described, and after a cylinder has been lined up and clamped on the table any of the chambers may be brought exactly into position for boring, making it impossible to bore two chambers out of parallel unless desired.

A machine of this design has been in operation for some time at the Topeka shops, and is giving first class satisfaction, both in its convenience in handling, and in the lower production cost. It is understood that arrangements have been made for the Tool & Railway Specialty Manufacturing Company of Atchison, Kansas, to handle machines of this type on the market.

Eight Years of Development of the Illinois Central and the Chicago & Alton, as Compared by Stuyvesant Fish.

Stuyvesant Fish, ex-President of the Illinois Central, has given out a statistical comparison between the eight years' development ended June 30, 1906, of the Illinois Central under his management and the development during the same period of the Chicago & Alton under the more or less direct management of E. H. Harriman. Comparisons between different railroads, especially between two railroads so different as the Illinois Central and the Chicago & Alton, can seldom be made with exact accuracy. Without attempting to examine into the qualifying circumstances of each case, we present below some of the most striking comparisons, showing in percentages alone the increase or decrease of the figures for the year ended June 30, 1906, over those for the year ended June 30, 1898:

Increases in Per Cent. 1906 *over* 1898.

	Illinois Central.	Chic. & Alton.
Gross earnings	89.03 per cent.	84.30 per cent.
Net earnings, taxes deducted	75.46 "	41.22 "
Fixed charges	16.64 "	154.02 "
Available for dividends	147.51 "	*37.08 "
Disbursed for permanent improvements, etc.	141.23 "	*96.83 "
Capital stock	81.03 "	79.31 "
Amount dividends paid on capital stock	153.44 "	*47.63 "
Funded debt, including leased line stock guar.	18.89 "	771.21 "
Funded debt, etc., per mile.	1.45 "	658.01 "
Capital stock and funded debt:		
Total capitalization	36.74 "	260.63 "
Per mile.	16.68 "	214.04 "
Fixed charges, incldg. interest, etc., per mile	*0.52 "	121.00 "
Ratio, fixed charges to net income, change	*31.12 "	84.41 "
Net income per mile.†	111.27 "	*45.23 "

*Decrease.
†Net earnings and other income less fixed charges, including interest, rents, and sinking funds.

Expenditures from income for permanent improvements, etc.:

Year.	Ill. Central.	Chicago & Alton.	Year.	Ill. Central.	Chicago & Alton.
1898	$1,726,452	$262,309	1904	$3,115,948	$205,809
1899	1,475,040	.....	1905	3,439,282	41,914
1900	2,416,674	.....	1906	4,164,739	8,318
1901	3,145,400	.....			
1902	4,994,502	.....	Total	$29,459,290	$518,350
1903	4,981,253	.....			

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

VIII.

THE RAILROAD STEAMSHIP LINE.

On the Pacific Coast of the United States and in Europe.

The Pacific coast of the United States and Canada is the terminus of great transcontinental railroads, and also of long trans-Pacific ocean lines. Furthermore, the population of Pacific sea ports is comparatively small, the local traffic is light, and the consequent mutual dependence between the railroads and the steamships is strong. There results here a more complete and extensive alliance between railroads and steamship lines than in any other section of the globe. Every transcontinental line has its secure arrangements, and several of them own steamship lines plying to all important countries of East Asia.

The alliance began soon after the first transcontinental road reached San Francisco in 1869. At that time the Pacific Mail Steamship Company had a line to China and Japan, to Australia, to Vancouver, local lines on the United States Pacific coast, and reached New York via Panama, where it connected through its contract arrangements with the Panama Railroad & Steamship Company. This was a well organized and strong system. The company had long exercised the independence that arises from monopoly, and the Pacific Railroad Company soon became dissatisfied with the freight supply in which the steamship company did entirely as best suited its own arrangements and its eastern service. In 1874 the railroad objections took the form of a California Company formed by the Union & Central Pacific Railroad Companies. This company, called the Occidental & Oriental Steamship Company, chartered four White Star steamers, and established an Oriental service. In the rate war that followed, rates went down to almost nothing, but the railroad made the quicker connections with New York. This competition, making loss to both parties, resulted in a working agreement between the rivals, which came near to being a real consolidation of shipping interests. The ships of the two companies alternated in dates of sailing, they had the same rates, rules and conditions of service; they had joint agents to solicit freight, and the agents were not permitted to make any discrimination whatever between the two companies on pain of discharge. There were two companies to watch the workings of this plan and protect their own interests.

This friendly competition went on for nearly 20 years, when the Southern Pacific bought a controlling interest in the Pacific Mail Steamship Company, but it did not in any way alter its service or apparent relations to the partner steamship company. In 1897 a group of Japanese capitalists backed by $6,000,000 and government influence and subsidy concluded to go into the shipping business. They formed the company known as the Toyo Kisen Kaisha and toured the Pacific coast of the United States for a suitable terminus. The Southern Pacific interests, foreseeing a destructive rate war, admitted them to a place at once in the San Francisco service, and this third company joined the others on the terms identical with those established at the close of the rate war in the '70s, when the two companies first agreed on the conduct of this service.

Encouraged by this result, some Chinese merchants in Hong Kong formed the China Commercial Company shortly after this, chartered four steamers and started to carry passengers to Manzanillo, Mexico, and to compete at San Francisco with the combined lines. These new comers were not received on terms of equality, but were beaten off the Pacific after six months of furious rate cutting.

The Atchison, Topeka & Santa Fe Railroad for several years after 1898 maintained a line to the Orient from San Diego, but the local trade was not satisfactory, and the relations of this railroad company with the Southern Pacific were so intimate that the San Diego service was discontinued in 1901, and in its place the company used the San Francisco lines maintained by the Southern Pacific interests. Portland, Ore., has the Portland & Asiatic Steamship Company rendering a service, almost exclusively freight, in connection with the Oregon Short Line and the Harriman roads. The steamers are chartered from the Hamburg-American Company.

Puget Sound and the Hill roads are served by a variety of Pacific carriers. The Great Northern has the Great Northern Steamship Company, which ran the splendid new steamers, the "Minnesota" and "Dakota" until the "Dakota" was wrecked in 1907. They operated alternately after the San Francisco manner with the vessels of the Japanese Nippon Yusen Kaisha and extended their services to Manila. The Northern Pacific once had a Northern Pacific Steamship Company operating with chartered steamers, but it now has a traffic agreement with the Boston Steamship Company, which operates a line of steamers to the Orient. The Boston Company seems to have a preferred claim. Such resi-

due of traffic as it cannot handle is provided for by outside contract.

The Hill interests are also engaged in the coasting trade of the Pacific. In 1901 the Pacific Coast Steamship Company, a company subsidiary to the Great Northern, took over the ships and good will of the Alaska Steamship Company, and it also operates a line from Seattle, Tacoma and Victoria to San Francisco, and to Guaymas and Mazatlan in Mexico; also minor lines on the California coast. The wide reach north, south and west of these distributaries and feeders gives the Hill roads a strong hold on Pacific commerce.

The population of regions adjacent to the Pacific is scanty and the new railroads at present under construction towards that coast will find the local traffic of ports aside from that produced by themselves to be so small that it has now apparently become the custom to prepare for the steamship line at the same time the railroad is decided upon. Some years hence the Grand Trunk Pacific Railway will reach the Pacific coast. Its first plan was to go to the now unused harbor of Port Simpson near the south point of Alaska. In 1904 the company announced that a contract had been made with the Allan Line (Steamship Company) for a trans-Pacific service from this port similar to their trans-Atlantic service now in operation in connection with that railroad. This will require a new fleet of steamers. New railroads to the Pacific ports of Mexico are also making contracts for steamer service for lines yet unbuilt.

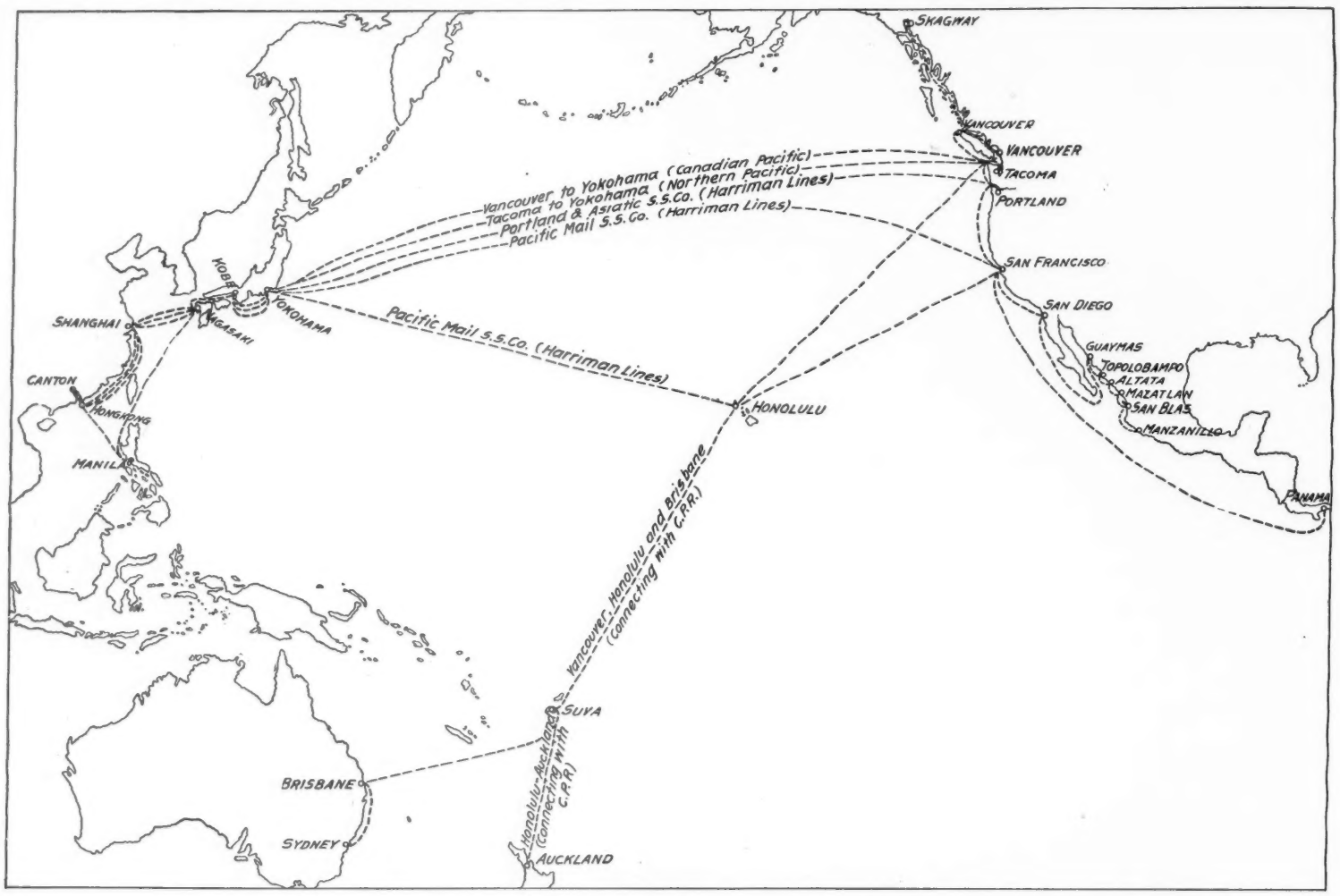
The Hamburg-American Steamship Company has entered into a contract with the Kansas City, Mexico & Orient road to run a line of steamers from Topolobampo across the Pacific as soon as the Orient road is completed. In 1906 the Orient Company already had a steamer in service from Topolobampo running north to Guaymas and south to San Blas. It has also a sailing vessel service from Topolobampo, which was being extended to San Diego in southern California.

The Canadian Pacific may be presented as the railroad with the most widely organized water transportation auxiliaries to be found upon the surface of the globe. In 1891 the establishment of its Hong Kong line set a new mark in transportation annals for then one company had a road clear across the American continent and steamers extending it to the limits of the China coast. In 1898 two steamers were also operated to Vladivostok.* In the company's report for the year ending June 30, 1907, the following fleet is reported:

Canadian Pacific Steamships.

Atlantic service	16
Pacific Coast service	11
British Columbia, Lake and River service	17
Pacific service	6
Upper Lake service (Great Lakes)	3
Ferry service	2
Total, all classes	55

That is to say, a transcontinental railroad operated two trans-oceanic services, connecting East Canada with Europe, and West Canada with Japan, China and Hong Kong. Lakes and rivers are used as feeders, and there were at one time rumors of proposed connections with the Trans-Siberian Railroad, and with the Yukon river through purchase of the White Pass & Yukon Railroad and a line of Alaska steamers. The steamship lines of this railroad company are not operated on working agreements, but are run by companies frankly owned by the railroad company. It also charters steamers which it operates on a line to New Zealand on alternate sailings with the Union Steamship Company at New Zealand.



Principal Railroad Steamship Lines on the Pacific.

THE THEORY OF THE RAILROAD STEAMSHIP LINE.

In this widespread combination of the railroad and the steamship line, the railroad is the dominant factor; the steamship is but a railroad attachment. When one stops to consider the capital involved, it appears natural that it should be so. Great Britain is properly hailed as the mistress of the seas, the world's great ocean carrier, and yet her merchant marine has a value not exceeding one-seventh part of the capital value of the British railroads* and a much smaller part of the value of the American railroads. The amount of money involved affects the order of development of transportation more than it reflects the value of the commerce. This is because the railroad is primarily a costly road, the ship but a vehicle using the highways of Providence.

That sea investments of railroad companies are but props to the railroads is clearly brought out in the annual report of the Canadian Pacific Railway for 1904. After giving a list of shipping amounting to nearly 150,000 tons,† the report states

**Social Economist*, 6 :283; *Scribner's* 10 :280; *Railroad Gazette*, Aug. 15, 1898, p. 615.

*The paid-up capital of British railroads at the end of 1906, was £1,283 million. The total British tonnage was 17,611,096. New freighters can be launched at from £10 per ton. Granting this rate of valuation (and it is too high) the value of the fleet is less than £180,000,000.

†An amount several times as great as that employed in the European commerce of the British Colonies two centuries ago, and it is also about six times as efficient per ton.

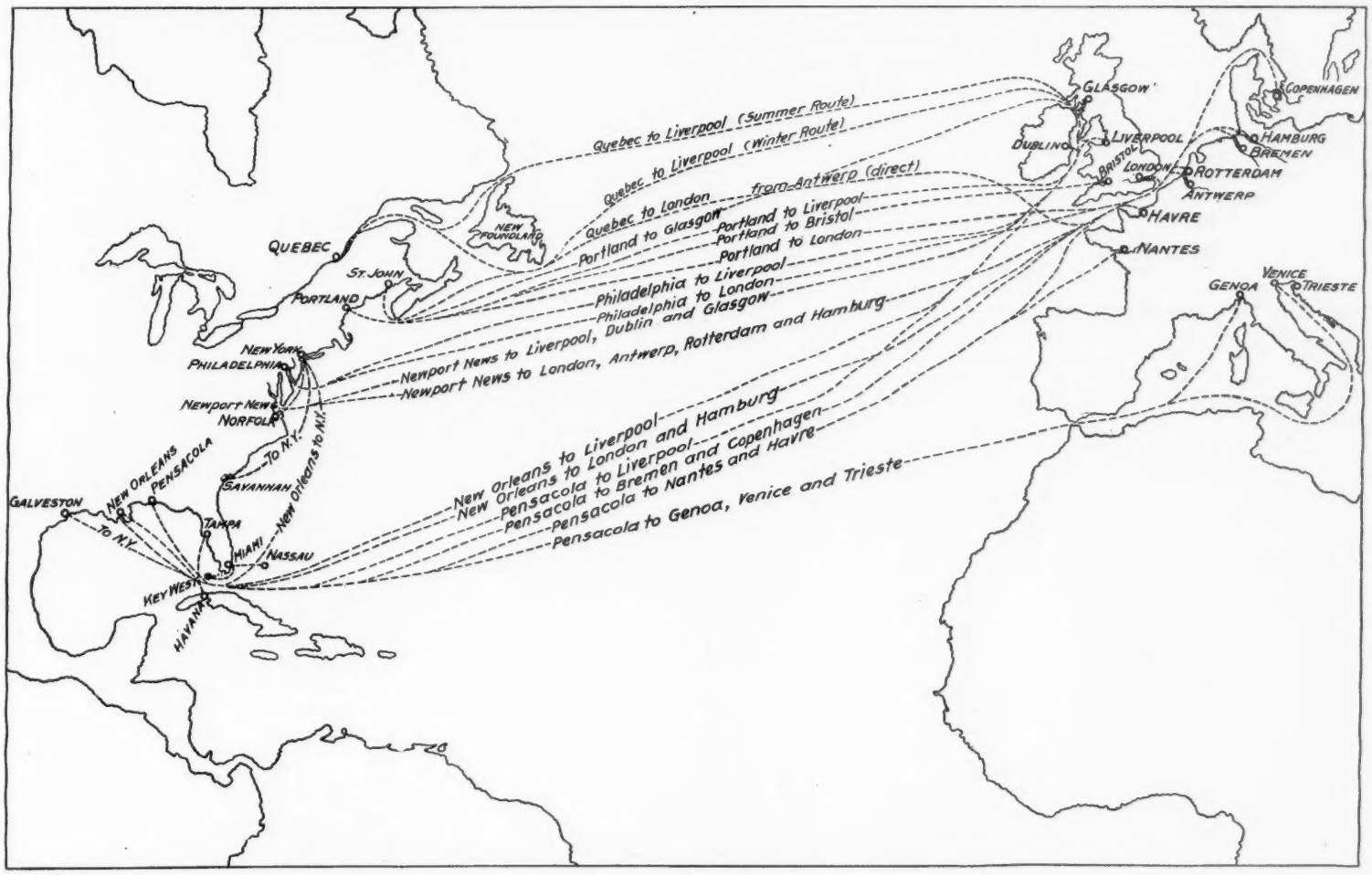
that the Atlantic steamer service shows no net revenue, due to demoralizing conditions, "nevertheless the steamship line has, as anticipated, proved a valuable auxiliary of the railroad." The report to the stockholders then proposed more new ships. The inevitable conclusion from the above seems to be that the railroad company can sometimes afford to lose money on a steamship line which serves as a freight collector or distributor for the railroad line.

British opinion also bears out this conclusion. The privilege for a railroad company to run steamers must be secured by special grant from Parliament, and such grants are bitterly opposed by shipping interests, because of the fear that the private vessel owner might be driven from the business, through the railroad steamers making rates that would be ruinous to a competing company that was an ocean carrier only. In the words of an editorial in *Fairplay*:* "It is well known that these steamers (belonging to the railroad companies) generally run at a loss, but the accounts of the steamers are merged in the general accounts of the companies and the steamers are supposed to make up as feeders for the lines what money is lost on their own making." Three years later an editorial in *Lloyd's Gazette*† stated that there seemed to be an attempt to make them more profitable. But this can scarcely be general.

A recent British government report (Dept. Paper 210 Foreign Merchant Shipping, London, 1905), discussing the fact that the Great Central Railway Co. runs steamers from Grimsby to Hamburg and carries emigrants pursuant to all the expensive regulations of the German law, says that this practice "is rendered profitable solely owing to the fact that this company is able to carry the emigrants through England on its own railroad lines to the port of embarkation for their trans-Atlantic destinations."

The building of terminal facilities is a necessary part of the connection between railroads and ships. It might apparently be undertaken by either of these carriers, it being the essential to one as to the other, but as a matter of fact the dock is usually built by the railroad because of the fixed location of the land carrier. The freedom of the seas gives the ship the opportunity to go to the best port that is already prepared, so it devolves upon the land end of the investment to provide the port and the harbor. Hence we find the state, the municipality and the railroad furnishing the necessary funds to provide the unloading facilities for the carriers by sea. The shipping company sticks to its element.

British harbors are usually enclosed stone docks—yet with so costly a type of construction several British railroad companies have built docks, thereby practically making harbors to which ships are glad to come. The railroads in question have in effect done for themselves the same thing that American roads have done when they contracted with foreign lines.



Routes of Principal Steamship Lines Run Primarily in Railroad Service on the Atlantic.

carried. These continental connections almost resemble ferries in the frequency of the service. From Hull on the east coast to Southampton on the south coast and at many intervening ports steamers pass each day to and from the continent. This daily service includes Hamburg on the east and Havre on the west, and where the sea is narrowest there are at times several railroad steamer connections daily, as at Dover and Brighton.

The small type of vessels required combines with British thoroughness to make ownership the prevailing practice rather than the traffic agreement, which is common in the trans-Atlantic steamship services of American railroads. The sea connection of British railroads with termini on the Humber estuary affords an interesting example of the British methods. The North Eastern Railway Company with a port at Hull, and the Lancashire & Yorkshire, having its port at Goole, have duplicate privileges from Parliament to own and run steamers to the following 17 ports: Copenhagen, Antwerp, Ghent, Dunkirk, Hamburg, Rotterdam, Bruges, Amsterdam, Delfzyl, Flushing, Hulst, Harlingen, Stettin, Lubeck, Danzig, Stockholm and Warhus. This grant guarantees the railroads in such connections as they may care to establish, it is not necessarily for immediate use.

The North Eastern Railway actually runs no steamers in its own name. It controls majority stock in a company running a line to Amsterdam, Rotterdam and Harlingen, and has an agree-

BRITISH RAILROAD STEAMSHIP LINES.

The distribution of British railroad steamship lines responds to the same laws as prevail in America. They are more common in the small ports than in the great ports. Harwich, Dover, Brighton, Southampton, Hull, Goole, etc., lack the traffic temptations to induce the establishment by ship owners of the complete and varied connections desired by railroads. They needed them and made them themselves. It was a very easy step for the British roads to operate steamers because the short sea journey to the continent bore about the same relation to railroad activity that our lake carriage does to our railroads. It has a local rather than an oceanic quality. The lively trade with the continent continues with a small type of vessel because of the frequent voyages required by the perishable nature of the traffic, and the large number of passengers

*See September, 1901, p. 482.
†Weekly, Sept. 16, 1904.

ment with Thos. Wilson Sons & Company, Ltd., ship owners of Hull, to work in unison with them to the remaining ports.

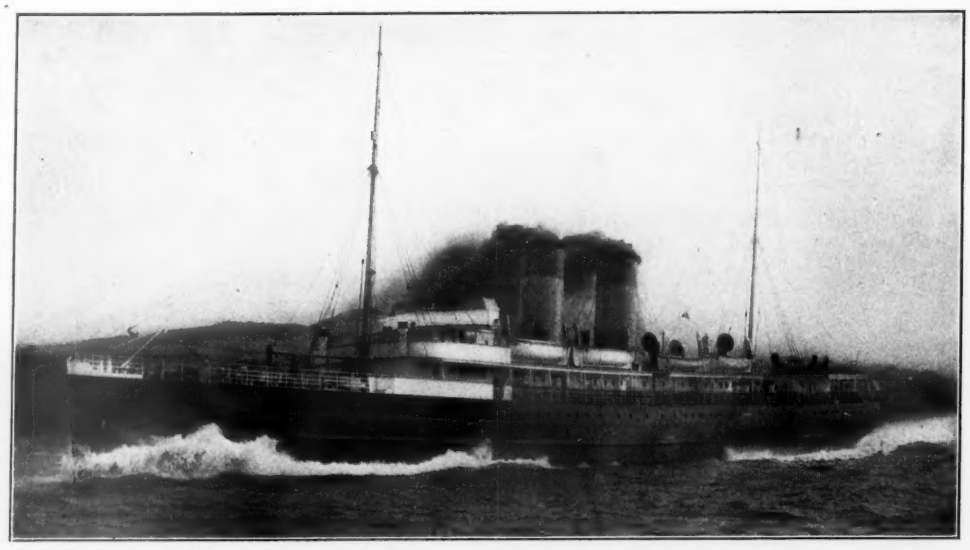
The Lancashire & Yorkshire Railway runs steamers to the first nine of the 17 ports named in the Parliamentary grant.

The Great Central Railway, having terminus at Grimsby, also on the Humber, has a Parliamentary grant to own and run steamers to eight ports as follows: Antwerp, Hamburg, Rotterdam, Gothenburg, Malmo, Landscrona, Eilsingberg and Halmstadt. The company runs steamers to the first three and had an understanding with Thos. Wilson & Company not to run lines to the other five ports so long as Wilsons kept a regular service.

The traffic with Ireland partakes of all the economic characteristics of that with the continent, and is chiefly carried on by the railroad steamship lines. There were announced for 1906 twelve of these lines connecting Great Britain with Ireland. Nearly all of them (two only are for Liverpool) run from small and often unnoticed ports where the five railroads have been able to reach the sea. From Liverpool and Glasgow there are lines of independent steamers.

The maturity of British industries gives less prospect than in America for probable extension of this form of organization in transportation.

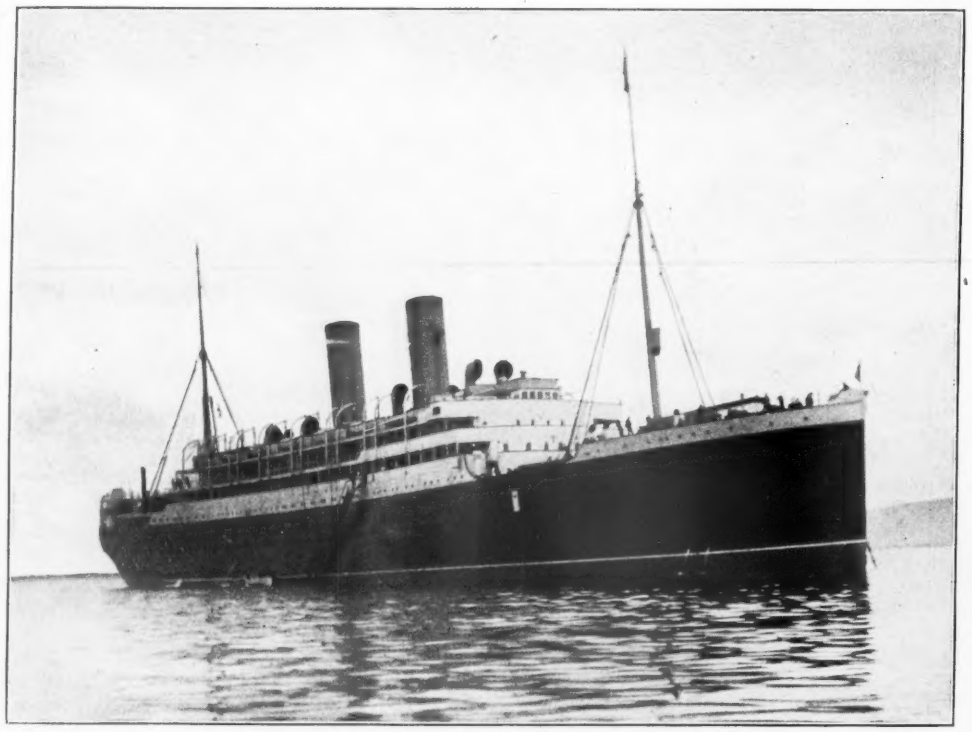
Thus far the British railroads have not ventured on trans-oceanic steamship connections, nor is it likely that they will find it necessary to do so. If it should be the case it will occur through the growth of some of the small ports, which are now lacking in connections, and probably in harbor facilities, but the large British ports are so well supplied with steamer connections, and cover the needs of a small country so adequately, that we may not expect much change in the near future.



Steamer Scotia, 21½ Knots; Holyhead-Dublin Service, London & North-Western.

EXPERIENCE IN OTHER FOREIGN COUNTRIES.

The managers of the newer railroads of Europe and Asia seem to be as generally convinced of the necessity of developing steamer connections as do those in America. The Anatolian Railroad Company loaned $600,000 to a steamship company to enable it to give better service in the Aegean sea. In 1901 the Chinese Eastern Railroad (Trans-Siberian) had 11 steamers at its disposal and was increasing them; in 1902 the railroad had six separate steamer lines running from Vladivostok, some of them running as far as the sea of Okhotsk, but Japanese competition made this service rather unsatisfactory—and it has since done worse things.



The Empress of Ireland; Atlantic Service, Canadian Pacific Railway.

The Roumanian State Railroads have been operating steamers from the Danube for a decade, and for a part of the time the line reached points as remote as Egypt and Antwerp.

The railroads of an undeveloped country like Russia are in a position akin to those of the United States. Gulf ports and steamship contracts are the rule. Since 1873 there has been a traffic association attending to this matter in the Baltic and usually making new arrangements each season upon the opening of navigation. This association ("Northern Oversea International Traffic") regulates, arranges and even goes so far as to deny to some lines permission to run steamers where they wish. In 1901 the contracts thus arranged by the Moscow Windau Rybinsky Railroad Company provided for service by four steamship companies from Windau to 10 ports distributed between Dundee, Dunkirk and Copenhagen. Arrangement was also made for service to the Rhine and for French and Spanish trans-shipments at Dunkirk.

In the management of state railroads in monarchial Europe we see the bureaucracy doing by rate control exactly the reverse of the common practice of American and English companies. The Anglo-Saxon Company runs a steamship line for the benefit of the railroad. The governments of Germany and Hungary, dominated by different and national motives and endowed with strong control arising from national power, use the railroads to favor and make profits for the pet national steamship line or lines, to which the railroad is made subservient. It is a part of the German export subsidy policy to give in some cases much lower railroad rates for export goods than for domestic traffic. This is a policy, however, which must be supported by taxation rather than industry. It is political rather than economic. In Hungary, the state has a railroad line to Fiume, and a subsidized line of steamers in the Adriatic. The Austrian government, using the port of Trieste, has the same. Four years ago competition arose and the Austrian steamers were cutting in on the trade of the Hungarian steamers at Fiume. The Hungarian government stopped this by arranging its railroad tariff, giving preferential rates on goods going out by the Hungarian steamers.

(To be continued.)

Foreign Railroad Notes.

A Berlin association of merchants which we may, perhaps, compare with the New York Chamber of Commerce, takes three standards for estimating the economic situation in Germany: Railroad earnings, number of workmen employed, and reports of the Imperial Bank. Now in 1907 (11 months) passenger earnings were 3 per cent. and freight earnings 6.4 per cent. larger than in 1906; against increases of 8 per cent. and 11.8 per cent. from 1905 to 1906. In the last half of 1907 fewer men were employed than one year before; and the average rate of discount of the Imperial Bank, which had been 4.99 per cent. in 1906, was 6.03 per cent. in 1907.

The Prussian State Railroad estimates for the fiscal year beginning with April next ask for 240,200 kilometric tons of rails, 105,800 of joint fastenings, spikes, etc., and 141,600 of ties and switches, the whole to cost about $18,000,000. The fuel requirements will be 8,845,900 tons of coal, 1,294,900 of coke, and 111,600 of lignite, to cost $31,700,000.

GENERAL NEWS SECTION

NOTES.

Figures have just been compiled by the Long Island Railroad showing that the company carried 23,950,547 passengers during 1907 on its trains. No passenger has been killed on the company's trains in 15 years.

The railroads of Mexico, particularly those connected with the government system, report heavy passenger and freight traffic. There is a considerable blockade at Vera Cruz of freight awaiting shipment to interior points.

The Iowa Railroad Commission has informed the express companies that they must comply with the long-and-short-haul provision of the Iowa railroad laws which have hitherto been applied only to freight and passenger rates.

An officer of the Erie is quoted as saying that the company will stand firm on its determination not to do away with piece work. The machinists of the road have bitterly opposed the piece work plan ever since its inception in the company's shops.

It is understood that the state of Sinaloa has voted a subsidy of $1,000 for every kilometer of road which the Kansas City, Mexico & Orient builds through that state on its way to Topolobampo. The company also has large bonuses from the state of Chihuahua.

Employees of railroads in the state of Mississippi are said to be preparing a large and impressive petition to the legislature opposing the proposal that a 2-cent law should be enacted. The employees see a connection between reduced fares and reduced wages.

The Ohio legislature has before it a bill to prevent the inspection of railroad men's watches by private individuals and to place the inspectors under the supervision and direction of the state. The bill requires watches to conform to certain standards but avoids reference to any specific makes.

The Midland Valley has this week been authorized by the State Corporation Commission of Oklahoma to charge 3 cents a mile for passengers. The state constitution makes a general rate throughout the state of 2 cents a mile, but allows the Corporation Commission some latitude. Other exceptions to the 2-cent rate were noted last week.

The County Attorney of Platte county, Neb., is about to bring criminal action against the Union Pacific under the new Nebraska anti-pass law. The company, through its attorney, has sent a letter to the railroad commission stating that it has given transportation to surgeons in accordance with continuing contracts made before the anti-pass law was enacted.

The Pennsylvania has collected data showing that 43 of its 85 principal officers are graduates of American colleges. The average age of these officers is 51 years and the average length of service with the Pennsylvania is 26 years. Sixty-seven of the 85 started their work for the company as beginners and, with a few exceptions, have been with the company ever since.

The Railroad Commission of Ohio decided on Feb. 17 that Ohio railroads are permitted, but not compelled, to issue excursion, commutation, mileage, and party-rate tickets; therefore, it is not in itself unreasonable and unjust discrimination for a railroad voluntarily to establish commutation rates between certain stations and to fail and refuse to establish like rates between all other stations on its lines.

Conferences have been held in New York during the past week on the proposal of the trunk lines to increase materially the terminal charge for split delivery of carload goods. A statement of the matter has been forwarded to the Interstate Commerce Commission by a special committee of the New York Produce Exchange, although it is not generally considered that the commission has jurisdiction in this case.

W. W. Finley, President of the Southern Railway, has openly challenged an examination of the circumstances which have led his company to contemplate a reduction of wages in the operating departments of his system. Mr. Finley, in effect, asks the Commissioner of Labor and the Chairman of the Interstate Commerce Commission to bring out all the facts, as a demonstration that his road is entitled to practise economy.

The Southern Pacific, through its counsel and special engineer, appeared before the United States Committee on Claims at Washington, February 24, advocating a favorable report upon the bill appropriating $1,600,000 to reimburse the company for its expenditures in reclaiming territory in southern California from the Colorado river floods of 1906. The committee has referred the bill to the Secretary of the Interior for a report from the government reclamation service.

The New York, New Haven & Hartford has given notice to the Interstate Commerce Commission that it will continue until May 1 the traffic arrangements with the Central Railroad of New Jersey, the Philadelphia & Reading, and the Baltimore & Ohio, for interchanging traffic via New York harbor. In December the New Haven gave notice that the arrangements with these roads would be canceled, but after a hearing by the Commission extended them to March 31. They are now to be extended further.

Governor Haskell, of Oklahoma, has ordered the Attorney-General of the state to institute proceedings to dissolve an alleged merger between the Chicago, Rock Island & Pacific and the St. Louis & San Francisco in Oklahoma. The Governor's order says that the interests of the two roads are pooled and are under the same management and that they are (meaning perhaps that they should be) in every sense competitive lines. The order demands a complete dissolution of the alleged combination and the perpetual maintenance of the two systems as distinct and separate roads.

In the controversy between the New York Central and John H. O'Brien, Commissioner of Water Supply, Gas and Electricity, with regard to the requests by the commissioner that the Public Service Commission require the railroad company to remove its overhead high tension transmission pole line and conductors along its right of way from a point north of Macomb's Dam bridge along the Harlem river, Harlem ship canal and the Hudson river to the city line, the railroad has filed a denial of the jurisdiction of Commissioner O'Brien and the Public Service Commission in the case at issue.

The Supreme Court, on February 24, gave the first decision in a series of cases attacking the validity of the Elkins anti-rebate law on the ground that this law was repealed by the Hepburn law. The case at issue was concerned with the appeal of the Great Northern from a $15,000 fine for granting a concession of 20 cents per 100 lbs. on 15 different shipments of oats from Minneapolis to Seattle in 1905, prior to the passage of the Hepburn law, so that the indictments, although returned after the passage of the law, were under the Elkins law. The court held that the anti-rebate provisions of the Elkins law were not repealed.

The annual report of the Insurance Department of the Pennsylvania Railroad shows that the company's employees extinguished 195 fires in 1907. These occurred in property valued at $7,500,000, yet the loss from them amounted to only $16,000. Fifty-one of the fires in Pennsylvania Railroad property during last year were caused by adjacent burning property. A loss of about $3,000 followed explosions of benzine, naphtha and lamps. Lighted cigars and cigarettes and matches cost the Pennsylvania over $49,000 in fires. Fires following wrecks caused a loss of about $43,000. Spontaneous combustion was responsible for a loss of $6,498.

The Rights of Capital.

The Canadian Board of Investigation, a body created to assist in adjusting difficulties between labor and capital, has given an opinion on the occasion of a demand by Grand Trunk telegraph operators for increased pay based on the increase which has been granted operators on the Canadian Pacific. The board held as follows:

"There are many considerations entering into this question. In our view there is the right of the man to receive a living wage and that right is paramount. The workman is entitled to get a fair day's wage for a fair day's work. What, however, often seems to be ignored is that capital and labor are both necessary in order to produce a profit.

"The object of the laborer should be to secure a fair share of this profit. But there is also to be considered the position of the man who advances the money to enable the undertaking to be carried on which gives employment. He, too, is required to receive a return for his money and his risk. A hundred millions of the capital stock of the Grand Trunk Road receives no dividends whatever. If such dividends on the preferred stock as are now being paid are still further reduced by the wage bill being increased, what must necessarily follow? The company cannot obtain further money for expansion, for it can be more remuneratively employed in other undertakings.

"This certainly would be a disadvantage to the vast number who find employment on the railroads. Then there are the constant demands of the public for the betterment of the service and equipment, for the increase of facilities and the bettering of the roadbed and general improvement in the accommodations. These can only be ob-

tained where the parties asked to advance the money can see some possibility of return for the advance.

"Our experience has led us to the conclusion that there seems to be an oversight on the part of the public of two things. First, that there is a continual demand for an increase of expenditure on the part of the company for facilities, and second, a continual demand for the reduction of the tariffs which furnish the moneys necessary to provide these facilities and accommodations.

"The growth of earnings is not keeping pace proportionately with the growth of expenses. If operating expenses and wages must be increased from time to time, and the public so demands, very serious consideration must be given to the proposals for the reductions of freight and passenger rates, insomuch as every reduction directly affects the ability of the railroads to pay the wages asked by their employees.

"There is no doubt that the cost of living has greatly increased, and that the employees of a railroad company are entitled to be better compensated to meet such increased cost, but surely they are not entitled to be compensated at the sole expense of people who have invested their money and who would in return be deprived of their means of livelihood. The public should bear their share. The railroad employee spends his money for the benefit of every other member of the community, from farmer to manufacturer, and if the employee has to obtain more money to meet his increased cost of living, other classes of the community who receive the benefit of the money he spends should contribute their share toward enabling him to get the money he has to spend."

More Investigations.

"I see by Bradstreet's and Dun's reports that buyers in the dry goods trade are placing very small orders. You will look into this, and ascertain whether it is due to the state of trade or to past financial transactions of theirs.

"I am informed that large wholesale houses in Chicago and New York have cut prices on certain classes of goods as much as 20 per cent. You will inquire about this, and discover whether it is alleged that legislation, state or national, has been the cause. Of course, lower prices would lead to great disorder at the bargain counters, which it would be my first duty to put down.

"I learn that the quotations of stocks have been low and business on the Exchange dull. You will investigate and report to me whether it is true that the sales of stocks have been so small that the revenues from stamp taxes have fallen off in a way to embarrass the treasury of New York, and that many worthy brokers have been brought to the verge of want. I desire that stocks be at once advanced in price."—*New York Evening Post.*

The World's Iron Production.

It is estimated that the production of pig iron in the world in 1907 was about 61,000,000 tons, as compared with 59,000,000 tons in the preceding year. Had it not been for the depression in the last quarter the increase would have been much greater. Of the total, the United States contributed about 42.3 per cent., Great Britain 17 per cent., and Germany 21.4 per cent.

The following table shows the world's production for a series of years:

Year.	Tons.	Year.	Tons.	Year.	Tons.	Year.	Tons.
1907..	*61,000,000	1904..	45,000,000	1902..	43,400,000	1900..	40,200,000
1906..	59,000,000	1903..	45,700,000	1901..	40,200,000	1890..	27,000,000
1905..	53,700,000						

*Estimated.

The production of the three leading producing countries, the United States, Germany and Great Britain, in past years was as follows:

Year.	United States, gross tons.	Great Britain, metric tons.	Germany, metric tons.
1907	25,781,361	10,500,000*	13,045,760
1906	25,307,101	10,100,000	12,473,760
1905	22,992,380	9,592,737	10,987,623
1904	16,497,033	8,562,658	10,103,941
1903	18,009,252	8,811,204	10,085,634
1902	17,821,307	8,679,535	8,529,810
1901	15,870,354	7,928,647	7,860,893
1900	13,789,242	8,959,691	8,520,541
1890	9,202,703	7,904,214	4,658,450
1885	4,044,526	7,415,469	3,687,434

*Estimated.

In 1810 the United States produced less than 54,000 tons, and the 1,000,000 ton mark was not reached until 1864. In 1876 the country produced only 1,867,000 tons.—*Wall Street Journal.*

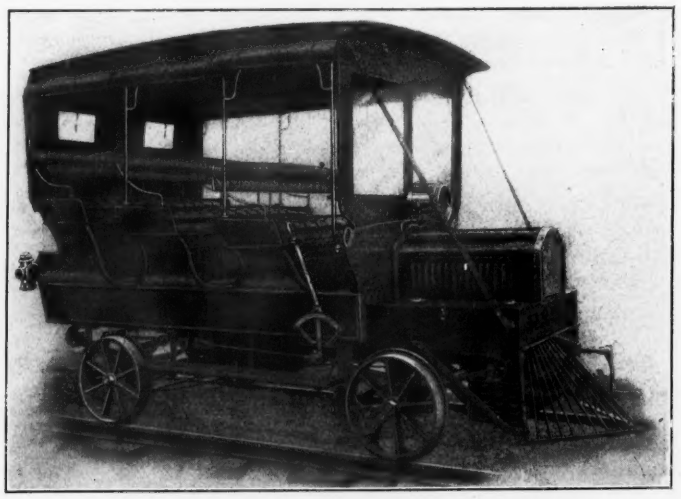
New Sound Steamboat Line.

A concern known as the New York & Providence Steamship Company has been incorporated in New York and proposes to compete with the Sound lines of the New York, New Haven & Hartford. Captain W. F. Bowman, who was master of the Enterprise Line Steamship "St. Croix" when this company suspended business, is said to be the leader in the enterprise.

Stover Twelve-Passenger Motor Car.

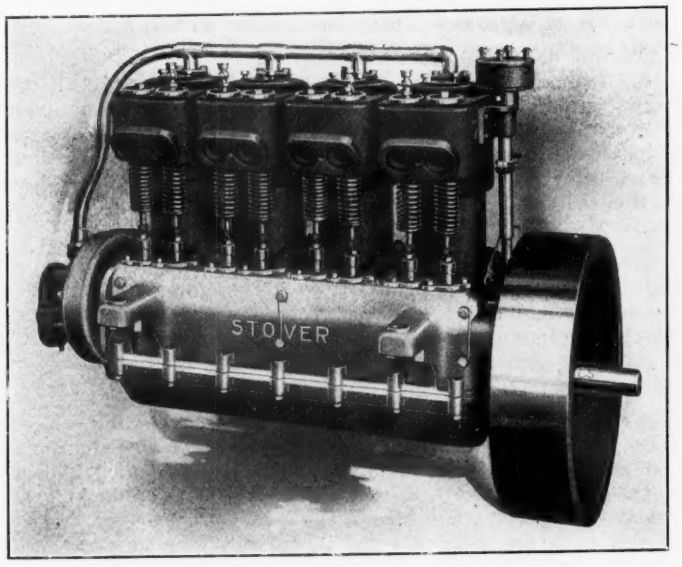
The 12-passenger motor car illustrated herewith is the Leeper type of car made by the Stover Motor Car Co., Freeport, Ill. The company has been making six-passenger cars, and is now making also this new type because of demand for cars of greater seating capacity. The six-passenger car answers the ordinary requirements of the division officer and a large number of them are in service on various roads. The three seats of the larger car flare beyond the body enough to give room on each for four good-sized men.

The car is driven by a vertical four-cylinder 30 h.p. gasolene engine. The accompanying photograph shows the engine with



Stover Twelve-Passenger Motor Car.

wiring and intake and exhaust pipes removed. The cylinders are 4½ in. x 5 in., water cooled. The crank case is of aluminum alloy and is in two castings, the upper half containing all of the bearings. The engine is attached to the frame by supporting arms cast on the upper half of the crank case, so that the lower half can be taken off in order to get at the bearings without disconnecting any other parts. The crankshaft is drop forged. Each cylinder is cast separately. The pistons have oil recesses and are fitted with four rings with square-cut joints. The piston rods are of large diameter and hardened. The connecting rods are drop forged, the bearings are phosphor-bronze and babbitt bronze, and the valves are drop forged in one piece and are interchangeable. The valve lifters are hardened steel and bronze. The timing gears are drop forged steel; they



Engine of Stover Gasolene Motor Car.

are completely enclosed in the crank case and run in oil. The cam shafts and cams are in one piece, made of steel, case hardened, and also run in oil. The intake and exhaust pipes can be quickly removed by loosening four nuts. There are no gaskets in the joints between pipes and cylinders. The water pipes are brass, and the pump is the gear type, made of bronze, except the bearing shaft, which is steel. The commutator has hardened steel contacts, and the terminals are all protected by a glass cover. The cylinders and bearings are lubricated with a Hill Precision oiler. The ignition is jump spark, operated ordinarily on a storage battery circuit, but the makers will also wire the engine for a dry battery to be used in emergencies.

The transmission is through friction cones, instead of the usual trains of gears. This mechanism is under the front seat. Two small cones, mounted on the transmission shaft, bear against the face of a large wheel on the transverse jack shaft. By shifting the cones toward the center or towards the circumference of this wheel, the transmission ratio may be lowered or raised. As one cone bears on the wheel, the car is driven forward; when the other bears, the motion is reversed, so that the car can move at maximum speed in either direction. All these changes are governed by the vertical lever at the right of the driver. The power is transmitted from the jack shaft to the rear axle by a chain on cast steel sprockets. The spark and gas levers are on a vertical column in front of the driver. The car is designed for 30 m.p.h. with full load on level track. There are brakes on all four wheels, applied through a hand wheel mounted on the same column as the gas and spark levers.

The frame is of heavy pressed steel channels and the body is suspended on long semi-elliptic springs with cast steel hangers, making an easy-riding car. The axles are 2½ in. in diameter and run in Hyatt roller bearings. The wheels are cast steel, 22 in. in diameter. The seats are upholstered in leather, and the floor and running board are covered with rubber matting. The standard body color is Brewster green. A chime whistle, operated by the exhaust, and a 9 in. acetylene headlight, generator and an oil tail light, are included in the equipment. The fuel consumption of the car is given as one gallon of gasolene for 12 to 15 car miles.

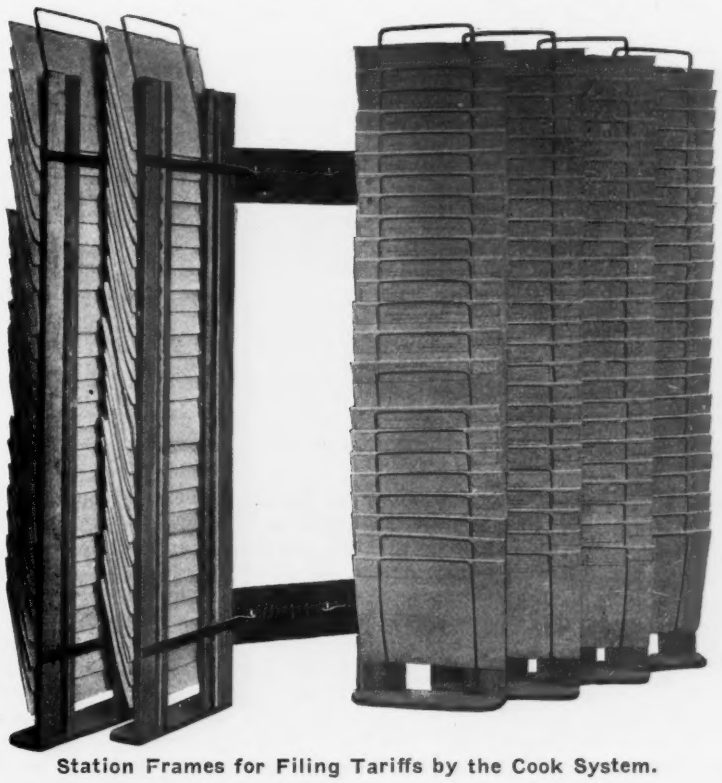
The Cook System of Filing Tariffs.

The file for railroad tariffs illustrated herewith is in use in the general offices and stations of a number of railroads by some of the largest commercial concerns in the country and by the War

Tariff Cabinet for General Freight Office.

Department. It was invented by C. W. Cook, Assistant General Freight Agent of the Atchison, Topeka & Santa Fe, and has been improved to its present form through several years of experience. It is convenient, simple and flexible as compared with the usual methods of filing tariffs, both in the general office and by station agents.

The basic feature of this file is a narrow rack or frame about 13 in. wide and 40 in. high, carrying wire holders rectangular in form, as shown in the illustrations. These holders are fastened to the rack with nuts and washers, and are adjustable vertically for pamphlets of any thickness. A rack has 26 wire holders. For general office use the racks or frames are mounted in a cabinet, usually holding eight racks. One of the illustrations shows this form and how a rack is drawn out and swung into position for use. Each tariff is separately filed so that it may be taken out and put back without disturbing any others. The tariffs are put in special folders to protect them. These folders carry the number and description of the tariff and the numerical filing order. Since



Station Frames for Filing Tariffs by the Cook System.

they are thus in place, much time is saved in consulting or filing them. It is said that tariffs seldom get disarranged.

A satisfactory system for a large number of tariffs in a general office is as follows: (1) Distance tables; (2) distance tariffs; (3) class tariffs, own issue first, followed by class tariffs joint with foreign road alphabetically arranged according to roads; (4) association tariffs; (5) special commodity tariffs alphabetically arranged according to commodity, local tariffs coming first and then joint tariffs alphabetically arranged according to roads.

For stations the plan is much simpler. The racks can be hung on the station wall, or any suitable support. One or more frames, as needed, can be put in, and others added as required. The agent thus has his tariffs conveniently and systematically arranged and instantly accessible. They also are convenient for public inspection and thus enable easy and satisfactory compliance with the law.

The use of this system of filing at local stations tends to do away with having agents wire the general freight office for rates and copies of tariffs which they may already have in the station, thus saving work at the general office, as well as use of the wires. The arrangement for quick and easy reference enables agents to quote rates promptly, and they quickly become trained to a better understanding of the tariffs. With a uniform plan for all stations, an agent changing from one station to another only needs to be instructed in the few details peculiar to that station. All details of the system are worked out in the general office and all an agent needs to do in familiarizing himself with the system is to follow the printed instructions furnished him.

The frames and cases used in the Cook filing system are made by the Rockwell-Wabash Co., Chicago.

Warren S. Stone on Wage Reduction.

Warren S. Stone, Grand Chief of the Brotherhood of Locomotive Engineers, is quoted as follows on the question of proposed wage reductions by the railroads:

"The threatened reduction of the wages of employees in train service is absolutely unjustified from any point of view. Their pay is based on a mileage basis, practically piece work, and they are only paid when there are services to be performed. Wages of employees in train service fall parallel with the shrinkage in business, plus the increased living expenses away from home. When their earnings are $150 per month their expense of living away from home is about 15 per cent., while at the present reduced rate of $70 —which has to be met by hundreds—under present conditions, that expense will increase to at least 20 per cent. of earnings, because they are held away from the home terminal until there is a full ton-

nage train to be handled, making a total automatic reduction already in wages from 60 to 70 per cent.

"The roads are getting the same return in freight receipts for the service rendered as they did when the business was good, and there is no consistency in asking men to accept further reductions than result from the present business shrinkage, and the full power of the Brotherhood of Locomotive Engineers will be used, if necessary, in an effort to prevent any further reduction, because it would be absolutely unjust."

Lower Per Diem Adopted.

The resolution adopted by the American Railway Association at Chicago, February 7, in favor of reducing the per diem rate on interchanged freight cars from 50 cents a day to 25 cents, has been confirmed by the letter ballot which was ordered, and the new rate goes into effect March 1. The vote represented almost the entire number of cars in the association, being as follows:

Yes—243 memberships, representing 1,601,355 cars owned or controlled.

No—75 memberships, representing 589,635 cars owned or controlled.

Not voting—17 memberships, representing 30,142 cars owned or controlled.

The total membership of the Association is 335, and the cars owned or controlled by the members, 2,221,132.

The majority requisite for approval is 168 memberships and 1,480,755 cars.

The Traffic Club of Philadelphia.

A meeting has been called for March 3, 1908, to adopt a constitution and by-laws, elect officers and formally organize The Traffic Club of Philadelphia. The proposed constitution and by-laws are similar to those of the New York Traffic Club. The first steps toward organization were taken at a meeting on December 17, 1907, called by a circular letter signed by 75 industrial firms in Philadelphia. A nominating committee has made a ticket with Robert S. Perry, President of Harrison Brothers & Company, President, and Henry C. Trumbower, Treasurer of John Wyeth & Brother, Secretary. Apparently industrial concerns are to be more largely represented than in the New York Traffic Club, for out of the 18 proposed officers and directors only three (and these directors, not officers) are railroad men. Of the 19 officers and governors of the New York Traffic Club, 12 are officers of railroads, steamship lines or traffic associations.

Effects of Texas Legislation and Taxation.

The following remarks are taken from an address by B. F. Yoakum at Fort Worth, Tex., Feb. 15:

It is for the people of Texas to consider whether or not it is to their interest to treat the existing railroads fairly, and fix laws on a fair and equitable basis as will invite capital to make further railroad investments in the state. I am not going into details in this connection further than to illustrate one point which should appeal to every man as being unjust and prejudicial to existing railroads and a hindrance to further construction. The railroads of Texas are capitalized at about $400,000,000, or $33,000 a mile. The Railroad Commission of Texas in its last annual report valued the properties at $16,500 a mile, or one-half of the capitalization. The tax assessors of Texas have assessed the railroad properties on the 1907 tax rolls at $23,000 a mile. One of these valuations must be wrong—either that fixed by the Railroad Commission for rate-making purposes or that assessed by the tax assessors for taxable purposes. If, however, the tax assessors use the same percentage of true value of property in preparing their assessment roll for railroads as they do for other property—which is about 38 per cent.—then they have placed the true value of the railroads at more than they are capitalized, and the owners are entitled to consideration.

Now let us see for a moment what restrictive legislation has accomplished for the state. During the last sixteen years there have been only 3,900 miles of railroad built in Texas, and more than one-third of this entire mileage has been constructed in the last few years by interests with whom I have been associated and largely under my influence. Texas needs and should have as rapidly as money can be found for such investments 10,000 miles of new railroad, and if the 10,000 miles cannot be financed and constructed more rapidly than railroad construction has taken place in Texas during the last sixteen years, which has been on an average of 245 miles a year, it will require forty years to furnish the 10,000 new miles necessary for the best interest of our state—too long for most of us to hope to see its accomplishment.

Let us see what our new sister state, Oklahoma, has accomplished within the last sixteen years, where they have until recently had liberal laws. There have been constructed in Oklahoma 4,400 miles of railroad within the same period—sixteen years—with only 25 per cent. of the area of Texas. To put it in another way, within this period capital has come forward for over four times as much railroad in Oklahoma, considering the area, as in Texas. In Louisiana, to the east of you, during the last sixteen years the railroad mileage has increased 150 per cent., and now has twice as many miles of railroad as that of Texas to the square mile. The liberal laws of Louisiana were the inducement.

Economy in Train Crews.

In connection with the Pennsylvania Railroad's present plan of retrenchment, about 75 brakemen have been taken off through line passenger trains between Jersey City and Washington, Harrisburg, Altoona and Pittsburgh. The purpose is to reduce each crew to a conductor, a baggageman and one brakeman. The front brakeman is the one dispensed with. The new plan will make all "inter-division" trains comply with the standard in operation which has been in vogue for a long time on the New York division between Jersey City and Philadelphia. The new rule affects the Philadelphia, Baltimore and Washington and the Philadelphia Middle and Pittsburgh divisions, of the Pennsylvania, which with the New York division, make up the lines east of Pittsburgh. Eighteen men have been taken off trains running out of Jersey City on the inter-division schedules, and the others come off trains having their headquarters on the other three divisions. The taking off of these men from the head end compels the younger men to fall back into the freight train service.

A Committee on Automatic Stops and Cab Signals.

The Railway Signal Association in assigning work for 1908 has appointed the following committee on the above subject: W. H. Elliott, New York Central, Chairman, New York City; A. R. Raymer, Pittsburgh & L. E., Vice-Chairman; E. M. Weaver, Long Island; G. D. Fowle, Penna.; J. V. Young, Boston & Maine; G. N. MacDougald, Virginian; W. E. Bullard, New York, New Haven & Hartford; W. McC. Grafton, Penna. Lines West; H. J. Foale, Wabash; D. M. Case, Cincinnati, N. O. & T. P.; E. E. Mack, Chicago & E. Ill.; Wm. Hiles, C., C., C. & St. L.; A. C. Holden, Great Northern; J. R. Decker, Michigan Central; G. W. Hulsizer, Southern; G. H. Dryden, Balt. & Ohio; E. G. Graham, Boston & Albany; J. A. Beoddy, Norfolk & Western.

The committee has been instructed to report on:

1. Cab Signals and Automatic Stops which are worthy of recommendation.

2. On proper location of Automatic Stop Trips for varied conditions of traffic.

3. The advisability of the use of Cab Signals as a substitute for fixed signals or adjuncts thereto.

The committee invites inventors, manufacturers and others interested to communicate with the chairman giving full descriptions, patent specifications and drawings.

Fellowships at the University of California.

In July, 1906, Clarence W. Mackay and Mrs. John W. Mackay, jointly, gave the University of California $100,000 to endow a professorship of electrical engineering. Part of the income was to be used for the salary of the incumbent of the chair, and the rest devoted to the furtherance of research work in electrical engineering in the university. Accordingly, two John W. Mackay Junior Fellowships in Electrical Engineering, of $600 a year each, have been established; they are open to all properly qualified university graduates.

The object of the fellowships is to enable students who have completed a college course to do research work with a view to aiding the advance of the application of electricity to scientific and industrial purposes. The holders of the fellowships are to live at the University of California. Experimental or other work, however, may be carried on outside the laboratories of the university. The appointment to each fellowship shall be for one year, which appointment may, however, be renewed, at the discretion of the Graduate Council of the university. Applications should be filed, as early as March 15, if possible, with the Recorder of the Faculties, Berkeley, Cal., to whom application should be made for announcement of courses and details of the work in electrical engineering and related subjects, and for application blanks, etc.

Eight Thousand Miles from Stump to Mill.

An Australian corporation has received a concession from the Russian Government to take out 30,000,000 ft. of timber a year from a forest in Siberia, which is 900 miles from Vladivostok. This is to be delivered in Melbourne, Australia, approximately 8,000 miles away, and nearly three times the distance from New York to San Francisco. In taking out the Siberian timber the Melbourne lumbermen will have to ship the entire year's cut in July, August, September and October, for during the rest of the year there is no open water at Vladivostok. Unmanufactured logs are

admitted free in Australia, while there is a heavy duty on all manufactured wood, the duty on lumber, for instance, being nearly $5 a thousand board feet. At Melbourne a new mill is being built to manufacture these logs into dressed stock and lumber. These Siberian lumber operations illustrate the pinch in the timber supply in all parts of the world.

Trolley Route from Boston to Chicago.

A traveler who has covered the trolley route between Boston and Chicago reports that out of 1,497 miles he had to travel but 230 by steam train. two by stage and two on foot. He changed cars 68 times.

Surprise Tests on the Lehigh Valley.

The superintendents of the Lehigh Valley have just had made 197 surprise tests of enginemen, and report perfect records in all cases; no engineman was caught napping. It is a rule on the Lehigh Valley that at least three officials shall take part in every test, and they sign a report giving full details.

TRADE CATALOGUES.

San Pedro, Los Angeles & Salt Lake.—The passenger department has prepared a unique booklet entitled "A Souvenir of Delightful Journeys." It is made to resemble an orange both in size and cover color, and the inside has suggestions, in the form of halftone views, of what may be seen on short journeys out of Los Angeles. Another book is entitled "The A B C of the Salt Lake Route," having a page for each letter of the alphabet, with a suitable sentiment thereon.

Hammer Drills for Mining.—Bulletin 60-A of the Sullivan Machinery Co., Chicago, is a 12-page pamphlet on Sullivan hammer drills for mining work. This is a comparatively new type of rock drill, similar, in a general way, to the large pneumatic hammer. The bulletin gives full information about their construction and operation.

Lightning Arrester.—Bulletin S. 118 of the Railway Specialty & Supply Co., Chicago, consists of six pages describing lightning arresters for either a.c. or d.c. circuits. It is called the Arc Damp Arrester, and the circular describes its application to block signal layouts and interlocking plants.

Rubber Belt Conveyors.—The Jeffrey Manufacturing Co., Columbus, Ohio, has published a 48-page booklet of illustrations to show the application of rubber belt conveyors for handling material of various kinds. Price lists and details of parts of the machinery are also given.

Roofing.—The current issue of *The Exchange*, published by the Standard Paint Co., New York, has among other examples of the use of Ruberoid roofing, photographs of a large freight shed of the Northern Pacific, and of a large hotel at Monte Carlo.

Water Proofing.—The Hydrex Felt & Engineering Co., New York, is distributing a reprint of the paper on "Water Proofing Engineering" read before the Boston Society of Civil Engineers in October, 1907.

Lighting Current Transformers.—Bulletin 1,061 of the Allis-Chalmers Co., Milwaukee, Wis., is about lighting current transformers. It also gives information on insulating oil and insulation tests.

MANUFACTURING AND BUSINESS.

The office of the Vulcan Iron Works, Chicago, has been moved to the new plant at 28 N. Irving avenue, near Fulton street.

C. E. Walker has gone to the Locomotive Appliance Co., Chicago, in charge of sales of locomotive cylinders and valves, effective March 1.

The Conley Frog & Switch Co., New South Memphis, Tenn., has decided to double its capacity by erecting another building and buying additional machinery.

Philip J. Nash has taken charge of the sales department at 863 Monadnock building, Chicago, of the Ernst Wiener Co., New York. Mr. Nash has had long technical and practical experience in the industrial railroad business.

Kopp signal glass is used for most of the signal glass, lenses and roundels in the installation in the yards of the new Washington terminal. The Railway Specialty & Supply Co., Chicago, are agents of the Pittsburgh Lamp, Brass & Glass Co., makers of this glass.

F. T. Hyndman, until recently Mechanical Superintendent of the New York, New Haven & Hartford, is now representing the Eldo Co., 100 William street, New York City. "Eldo" is a protective coating for metal. The claims for this product are that it is made from a mineral gum and is perfectly elastic, is applied easily, dries rapidly, will resist high temperature, is a non-conductor of electricity and will not deteriorate. In color it is a glossy black.

The Federal Railway Signal Co., a New Jersey corporation, with office and works at Albany, N. Y., has been reorganized. A new company, the Federal Signal Co., formed with a New York charter, assumes all the assets and liabilities of the old company, and new capital has been provided for carrying on the business. The officers of the new company are: President, A. H. Renshaw; Vice-Presidents, Eugene Seitz and John T. Cade; Secretary, Frederic Pruyn, and Treasurer, Eugene Seitz.

Richard S. Mercer, who has for several years been representative at New York of the American Brake-Shoe & Foundry Co., Mahwah, N. J., died on February 23. Mr. Mercer was 46 years old. He was born at West River, Md., and, after being educated at Charlotte Hall Academy, began work in 1882 on the Pennsylvania. He was in the construction department for a number of years and then went to the maintenance of way department, serving for some years as supervisor of the Middle division until he resigned to go to New York.

The Robins New Conveyor Co., New York, which was recently incorporated, will be operated under the management of Thomas Robins, who founded the Robins Conveying Belt Co. in 1896 and was President of that concern until March, 1907, when its management passed into other hands. C. Kemble Baldwin is Chief Engineer of the new company. He has served in the older company in the same capacity for the last seven years. The offices of the company are at 38 Wall street, New York, and 1240 Old Colony building, Chicago.

The Allis-Chalmers Co., Milwaukee, Wis., will furnish the equipment for the central station in the electrification of the plant of the Clark Thread Co., Newark, N. J., plans for which have been completed. The plans call for a generating plant of 10,000 k.w. supplied by five steam turbine units. Only one unit will be installed at the outset; this will drive a three-phase, 60-cycle, 600-volt generator, rated at 2,500 k.w. on normal load. The turbine will run condensing. About 2,500 h.p. in induction motors will be installed at the start. The complete electrification of the plant will be carried out gradually.

H. U. Wallace, President of the Wallace-Coates Engineering Co., Chicago, has resigned to become General Manager of the Chicago, Lake Shore & South Bend, an electric line nearing completion between South Bend, Ind., and Kensington, Ill., where it connects with the Illinois Central. Mr. Wallace is a graduate of Purdue University, and was with the Illinois Central for a number of years, being Division Superintendent for three years and Chief Engineer for three years. He then became Third Vice-President of J. G. White & Co., New York, and for the past two years has been at the head of the Wallace-Coates company.

Robert F. Carr and several associates in the Dearborn Drug & Chemical Works, Chicago, makers of boiler compounds, have bought the holdings of the estate of the late William H. Edgar, who died two years ago. At a meeting of the stockholders, followed by a meeting of the Directors, the following officers have been elected: President and General Manager, Robert F. Carr; Vice-President, George R. Carr; Vice-President, Grant W. Spear; Vice-President and Eastern Manager, William B. McVicker; Assistant General Manager, J. D. Purcell; Assistant Secretary and Chemical Director, W. A. Converse; Assistant Treasurer, R. R. Browning; Superintendent, A. E. Carpenter. C. M. Eddy's holdings were also taken over; he desired to devote all his time to personal business interests.

Wynn Meredith, Member of the American Institute of Electrical Engineers, has become a partner in the firm of Sanderson & Porter, New York, engineers and contractors, and will have charge of the western office which they have opened in the Union Trust building, San Francisco, Cal. After technical training at the University of Illinois, Mr. Meredith, in 1888, worked on construction and operation of lighting and electric railway properties. He was connected with the electrical plant of the World's Fair at Chicago in 1893 and the California Fair in 1894. He was later associated with Hasson & Hunt, and then became a member of the firm of Hunt, Dillman, Meredith & Allen, San Francisco, Cal. During 15 years' residence in California, Mr. Meredith has been engaged in general engineering work, and including much of the hydro-electric and power transmission work on the Pacific coast, in the United States and Canada.

Iron and Steel.

The New York, Ontario & Western is reported to have ordered 3,100 tons of rails from the Lackawanna Steel Co.

The Chicago & North-Western has given the McClintock-Marshall Construction Co. a bridge contract requiring 1,400 tons of fabricated steel.

The Delaware, Lackawanna & Western has ordered 8,500 tons of open hearth 90-lb rails from the Bethlehem Steel Co. The price will be somewhat higher than the standard figure for Bessemer steel.

The Great Northern has ordered 20,000 tons of rails from the Carnegie Steel Co. and 15,000 tons from the Lackawanna Steel Co. The Pennsylvania Steel Co. has orders from the Great Northern for 5,000 tons of open hearth and 5,000 tons of Bessemer rails; from the Atlantic Coast Line for 8,000 tons, and from other roads for 12,000 tons. The latter amount is in addition to the company's share in the recent Pennsylvania Railroad order.

OBITUARY NOTICES.

William F. Hallstead, formerly General Manager of the Delaware, Lackawanna & Western, died last week at his home in Scranton, Pa., at the age of 72. Mr. Hallstead was born at Benton, Pa. He entered the service of the Lackawanna as brakeman in 1852, and continued in the service of the company 47 years. He was promoted through the different grades of the operating department until in 1872 he was made Superintendent of the main line. In 1886 he was appointed General Manager, which office he held for 13 years.

James Dun, Consulting Engineer of the Atchison, Topeka & Santa Fe, died at St. Augustine, Fla., of heart trouble, on February 23. Mr. Dun had been on the Santa Fe for the past 17 years. He was born on September 8, 1844, at Chillicothe, Ohio. He began railroad work when he was 22 years old as a chainman in an engineer corps on the Indianapolis & Cincinnati, which is now part of the Cleveland, Cincinnati, Chicago & St. Louis. Next year he was appointed Assistant Engineer of the Atlantic & Pacific, now part of the Atchison, Topeka & Santa Fe. Four years later he went to the Missouri Pacific as Assistant Engineer, and in 1874 was made Engineer of Union Depot Co., at St. Louis, Mo. In 1877 he was appointed Superintendent of Bridges and Buildings of the St. Louis & San Francisco, and, after serving in this position for a year, went to the Atchison, Topeka & Santa Fe as Chief Engineer. In 1900 he was made Chief Engineer of the whole Santa Fe system, including the Coast Lines. He was appointed Consulting Engineer of the system in the fall of 1906.

James Dun.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Mechanical Engineers.

The March meeting of this society is to be held on Tuesday evening, March 10, in the Engineering Societies building, West Thirty-ninth street, New York. An address will be made by Dr. Charles P. Steinmetz, Professor of Electrical Engineering at Union University, on "The Steam Path of the Steam Turbine."

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Canadian Pacific.—F. W. Peters, Assistant Freight Traffic Manager of lines west, has been appointed Assistant to the Second Vice-President, with office at Winnipeg.

Philadelphia & Reading.—Harry E. Paisley has been appointed Treasurer of the railroad company and also of the Reading Company and the P. & R. Coal & Iron Co. in place of Richard Tull, deceased. John S. Sneyd has been appointed Assistant Treasurer in place of Mr. Paisley.

Seaboard Air Line.—L. G. Haas, heretofore Assistant General Manager of the Baltimore & Ohio, has been appointed Agent for the Receivers of the S. A. L. He will have charge of certain engineering features; of extensions and of the industrial department, his duties not conflicting with those of Mr. Garrett, chief executive officer for the Receivers. George Hodges, heretofore Assistant to the General Manager of the Baltimore & Ohio, has been appointed Assistant Receivers' Agent of the S. A. L.

Operating Officers.

Baltimore & Ohio.—L. G. Haas, Assistant General Manager, has resigned. See Seaboard Air Line under Executive, Financial and Legal Officers.

Fourche River Valley & Indian Territory.—William Collins has been appointed General Manager in place of F. C. Faust, resigned; office at Fourche, Ark.

Kansas City Southern.—Charles C. Riley has been appointed General Manager and Superintendent of Transportation, effective February 15. Mr. Riley was born in Indiana and was educated at Butler University. He prepared himself for the medical profession, but in 1888 entered the railroad service on the Cleveland, Cincinnati, Chicago & St. Louis. He held various positions in the transportation department until April 10, 1897, when he went to the Baltimore & Ohio Southwestern as Superintendent of Car Service and Superintendent of Transportation, which place he held until December 1, 1900. In 1901 he was instructor at the College of Physicians and Surgeons at Indianapolis. From October, 1901, to July, 1903, he was Car Service Agent of the Chicago Great Western, and then for a year was Superintendent of Car Service of the Erie. From that place he was promoted to be Superintendent of Transportation, resigning from this position this month.

National of Mexico.—J. C. Sielski has been appointed Superintendent at San Luis Potosi in place of A. Larkin, deceased.

New York, New Haven & Hartford.—E. T. Horn has been appointed Assistant Superintendent and D. F. Stevens Trainmaster of the Shore Line division. P. W. J. Smith has been appointed Passenger Trainmaster of the New York division, with office at the Grand Central Station, New York City; C. H. Motzett has been appointed Freight Trainmaster of the New York division, with office at Harlem River, N. Y. E. H. Morse has been appointed Passenger Trainmaster of the Boston division, with office at Boston; F. S. Hobbs, Freight Trainmaster of the Boston division, with office at South Boston.

New York, Chicago & St. Louis.—The lines of this company have been divided into three operating divisions, as follows: Buffalo division, Buffalo to Conneaut; Cleveland division, Conneaut to Bellevue; Fort Wayne division, Bellevue to Chicago.

The Superintendent of the Buffalo division is W. F. Watterson, office at Buffalo, N. Y.; Trainmaster, G. C. Todd, office at Conneaut, Ohio.

The Superintendent of the Cleveland division is R. W. Mitchener, office at Cleveland, Ohio; Trainmaster, C. E. Maxfield, office at Cleveland.

The Superintendent of the Fort Wayne division is S. K. Blair, office at Fort Wayne, Ind.; Trainmaster, E. S. Kirby, office at Fort Wayne.

W. I. Bliss has been appointed Superintendent of Telegraph, in place of R. W. Mitchener, promoted.

Traffic Officers.

Canadian Pacific.—W. B. Lanigan has been appointed Assistant Freight Traffic Manager at Winnipeg, Man., in place of F. W. Peters, promoted.

Chicago, Milwaukee & St. Paul.—R. M. Calkins, hitherto Assistant General Freight Agent at Chicago, has been appointed General Freight and Passenger Agent of the lines west of the Missouri River, with office at Butte, Mont. E. C. Nettels, also Assistant General Freight Agent at Chicago, will succeed to the place vacated by Mr. Calkins.

Mobile & Ohio.—E. A. Bynum, appointed Assistant General Freight Agent, with office at New Orleans, in place of N. M. Leach, has taken up the duties of his office.

Pennsylvania Lines West of Pittsburgh.—W. M. Wallace has been appointed Division Freight Agent of the Erie & Ashtabula division in place of H. M. Bradley; office at Erie, Pa.; effective April 1.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & Pacific.—E. E. Chrysler, Master Mechanic at Chickasha, Okla., has resigned.

International & Great Northern.—F. S. Anthony has been appointed Master Mechanic of the Gulf division at Palestine, Tex. J. B. Dolsen, Foreman of the Car Department at Palestine, has resigned.

Mexican Central.—F. L. Carson has been appointed Master Mechanic of the Torreon division in place of O. R. Hale, transferred.

CAR BUILDING.

The Atlanta, Birmingham & Atlantic has ordered 112 coal cars of 80,000 lbs. capacity and 30 cabooses from the South Atlantic Car & Manufacturing Co.

The Mexico, Santa Fe & Perry Traction Co., under construction in Missouri, intends to ask bids on rolling stock soon. S. L. Robison, Mexico, Mo., is President and General Manager.

The J. D. MacArthur Co., Ltd., Winnipeg, Man., as reported in the *Railroad Gazette* of February 14, has ordered from the Hicks Locomotive & Car Works, for delivery on April 1, 50 flat cars of 60,000 lbs. capacity and one caboose. Bodies and underframes will be of wood.

RAILROAD STRUCTURES.

ALEXANDRIA, LA.—A contract has been given to Edward Crebo, of Kansas City, to build the union passenger station to be used by the Texas & Pacific and the St. Louis, Iron Mountain & Southern.

CAINSVILLE, ONT.—The Toronto, Hamilton & Buffalo is planning to put up a new steel bridge on heavy concrete abutments here.

GRAND FORKS, B. C.—It is said that the Canadian Pacific will make improvements here, including roundhouses, at a cost of $150,000.

MINNEAPOLIS, MINN.—The Chicago, Milwaukee & St. Paul, it is said, has bought 40 acres of land adjoining the city limits as a site for shops and terminals. This is preparatory to changes which will follow the extension of the company's lines to the Pacific coast.

MONTREAL, QUE.—Bids are being asked for by the Canadian Pacific for the construction of the new stock yards in this city.

OTTAWA, ONT.—The Canadian Railway Commissioners have authorized the Canadian Pacific to build bridges as follows: Over Belly river at Lethbridge, Alta.; at mile 35.2 over Carpenter creek, B. C.; at mile 0.72 over Fraser river, Mission branch, B. C.; at highway crossing at Bala, Ont.; at mile 7.32, Mud Branch, Thames river, Ont.; at mile 8.2 over Thames river, Ont.; at mile 9.14, Huron street crossing, Embro, Ont.; at mile 18.9, Brockville branch, Ont.; at mile 34.6 over Badger creek, Man.; at William street subway, also approved plan of abutment and piers of proposed bridge over Pine street, at Woodbridge, Ont.

QUEBEC, QUE.—The Quebec Bridge Co. has decided to rebuild the steel cantilever bridge over the St. Lawrence which collapsed last spring.

ST. STEPHEN, N. B.—The New Brunswick Southern is asking Parliament for authority to build a bridge over the St. Croix river.

TRINITY, TEX.—The Beaumont & Great Northern is planning to make improvements here, to include shops and a roundhouse.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

AMERICAN RAILROAD OF PORTO RICO.—This company expects soon to finish the cut-off from Hormigueros south to Lajas, 12 miles. (April 12, p. 531.)

A branch line is to be built this year from San German, east to Sabana Grande, nine miles. This work includes one large bridge and several smaller structures. All the work is being done by the company's forces.

ATLANTIC, QUEBEC & WESTERN.—The Canadian Railway Commissioners have approved the location of this company's line in the townships of Perce, Mal Baie and Douglas, county of Gaspe, Quebec, mile 60 to 90; also in section 3, mile 20 to 30.8, and section 10, mile 90 to 102.4 through the townships of Douglas and York, county of Gaspe.

BATON ROUGE, HAMMOND & EASTERN.—See Illinois Central.

CANADIAN NORTHERN.—This company, it is said, has had a large force working all winter on the Hudson Bay line from Etoimami, Sask., north. The line is finished to Pass Mission, at the junction of the Saskatchewan and Carrot rivers, about 100 miles. The surveys to Ft. Churchill call for a line 425 miles long.

Several improvements, it is said, are to be made this year on the line between Port Arthur and Winnipeg. The company intends to replace 30 miles of the present rails between Atikokan, Ont., and Rainy River with 80-lb. rails, and make extensive improvements on this division, mainly at Fort Frances.

CHERRYVALE, OKLAHOMA & TEXAS.—Surveys reported made by this company for its proposed line from Cherryvale, Kan., via Pawhuska, Okla., and Guthrie, to Geary. General Manager J. H. Brewster is quoted as saying that capital has been secured to complete this section of the line. S. M. Porter, President, Caney, Kan. (July 19, p. 83.)

DENVER, LARAMIE & NORTH WESTERN.—This company, which has projected a line from Denver, Colo., to the northern boundary of Wyoming, about 500 miles, is said to have bought recently 160 acres of land in Denver as a site for terminals. Rights of way are reported secured for the line. S. Johnson, President; J. O. Curry, Treasurer; J. T. West, Secretary, and former Senator Harris and Judge J. T. Millkan, of Kansas, are said to be interested. (Sept. 27, p. 370.)

EVANSVILLE, MT. CARMEL & OLNEY INTERURBAN.—Incorporated in Indiana, with a capital of $10,000, to build an electric line from Evansville, Ind., northwest to Olney, Ill., about 60 miles. A. Knoop, President, Olney; G. W. Couerter, Secretary, Mt. Carmel. The directors include G. J. Siebert, J. Laubscher, E. O. Lockyear, of Evansville; T. Newall, E. B. Bixby, of Cynthiana; J. F. Siebert, J. O. Smith, of Lancaster; A. Knoop, F. W. Boyer, J. F. Hyatt, of Olney.

FORT WAYNE & SPRINGFIELD TRACTION.—Plans under way to build a line from Decatur, Ind., south to Richmond, Ind., 70 miles. Officials of this company are reported to be interested.

GRAND TRUNK PACIFIC.—Foley, Stewart & Welch, contractors for 120 miles of the line from Edmonton, Alb., west, have sublet 30 mile sections to J. McAllister, M. McKenzie and B. Baker. The remaining 30 miles is to be sublet in one and two-mile sections.

ILLINOIS CENTRAL.—Construction work on the connecting links on the Birmingham extension to a connection with the Central of Georgia have been finished, and the line is to be ready for operation April 1. The line from Jackson, Tenn., to Birmingham, Ala., 219 miles, is over the Illinois Central tracks to Perry, 5.80 miles, thence over the Mobile & Ohio to Ruslor, Miss., 51.48 miles. The Mississippi & Alabama in Mississippi and the Alabama Western in Alabama extend from Ruslor to Haleyville, Ala., 80.07 miles. From Haleyville the company has trackage rights over the Northern Alabama to Jasper, 40.69 miles, and from Jasper over the Kansas City, Memphis & Birmingham to Birmingham, 40.96 miles. This will give the Illinois Central a through line to Birmingham. The line from Corinth, Miss., to Haleyville, Ala., 80.1 miles, was opened for traffic Feb. 10. The company has finished terminals in Birmingham at a cost of $2,000,000. It is announced that through trains from Chicago to Birmingham, Ala., will probably be established about April 1.

Work on the Memphis & State, which is to be a double-track line from Aulon, Tenn., to the Nonconnah yard, about seven miles, has grading finished and about one-half the track laid. It is expected to have the line open for traffic about March 15.

The work under way on the Yazoo & Mississippi Valley relaying the present track from Natchez, Miss., northeast to Harrison, 27.8 miles, with 75-lb. rails, will probably be finished about March 15th.

The new double-track belt line being built around Memphis, Tenn., is expected to be put in operation March 15th.

Train service was begun on the Baton Rouge, Hammond & Eastern on February 27. This line joins the Illinois Central at Hammond, La., and connects at Baton Rouge with an extension of the Southern Pacific, which is being built from Lafayette, La., to Baton Rouge. A saving of about 50 miles is accomplished by this short route between the Illinois Central and the Southern Pacific, which also saves going through the congested terminals at New Orleans.

MATAMOROS & SANTA CRUZ STREET RAILWAY.—A St. Louis syndicate organized by W. H. Bixby, T. West, S. Fordyce, H. Harstick, E. Scoot and R. Brookings, has recently bought this Mexican line. It is the purpose of the new owners to rebuild and electrify the line, also to extend it to a connection with the National Railroad. The proposed improvements include a line to Brownsville and the absorption of the Rio Grande Railroad, operating 22 miles from Brownsville, Tex., north to Point Isabelle. This is a steam road, which it is proposed to convert into an electric line. The work will include a bridge over the Rio Grande at Brownsville, for which permission to build will have to be obtained from both the United States government and the Mexican government.

MEMPHIS & STATE.—See Illinois Central.

MEMPHIS, PARIS & GULF.—This company is now in operation from Nashville, Ark., southwest to Ashdown, 26.9 miles. The company proposes to extend the road this summer. The projected route is from Memphis, Tenn., via Little Rock, Ark., to Paris, Texas, 400 miles.

MEXICAN CENTRAL.—This company is improving its track between Chihuahua and El Paso and adding heavier rails. Five

thousand tons of 75-lb. rails are being distributed to replace the 56-lb. rails now in use.

Montana Railroad.—This company has finished grading work on a revision of line from Lombard, Mont., to mile 36.2, near Minden. Ditmer, Bradbury & Wheitbrec, contractors. Tracklaying is expected to be finished in March. The work included eight tunnels and one viaduct.

Pittsburgh, Binghamton & Eastern.—The New York Public Service Commission (Second district) has granted permission to this company to change that portion of its proposed route within the state of New York. The line is projected from Binghamton, N. Y., to Clearfield, Pa., 225 miles. Twenty-one miles built in 1907. The Holbrook, Cabot & Rollins Corporation, contractor. (Jan. 17, p. 105.)

Rio Grande Railroad.—See Matamoros & Santa Cruz.

Texas Roads.—A company is being organized by Dr. C. F. Simmons, of St. Louis, and associates to build a line from San Antonio, Texas, south to Rio Grande, on the Mexican border, about 200 miles, with a branch east to Corpus Christi, 50 miles. Rails are said to have been bought to be laid on the first 40 miles.

Union Traction Company.—Incorporated in Texas, with office at Clarksville, in Red River county. The company proposes to build an electric line from Texarkana via Sherman and Ft. Worth to Mineral Wells. C. P. Moore, President, and J. T. Upchurch, Secretary and Treasurer.

West Texas & Northern.—The West Texas Construction Company has been organized to build this proposed line from Stanton on the Texas & Pacific to Lubbock, the county seat of Lubbock county, 110 miles. Fourteen miles graded north from Stanton. (Nov. 15, p. 666.)

Yazoo & Mississippi Valley.—See Illinois Valley.

RAILROAD CORPORATION NEWS.

Atlantic Coast Line.—The Atlantic Coast Line Company of Connecticut, which is the holding company for the Atlantic Coast Line Railroad, has declared a quarterly dividend of 2 per cent., reducing the annual rate from 10 to 8 per cent.

Baltimore & Ohio.—This company has sold $6,000,000 one-year 5 per cent. collateral notes dated March 2, 1908, to Speyer & Co. and Kuhn, Loeb & Co., of New York. These notes are in denominations of $10,000 and $25,000 and are secured by $8,000,000 refunding 4 per cent. bonds of the Pittsburgh, Lake Erie & West Virginia "System," which includes 1,687 miles of Baltimore & Ohio lines, including the Pittsburgh & Western and the Cleveland, Lorain & Wheeling.

Gross earnings for January decreased $1,188,000, or 19 per cent. Expenses were $201,000 less, leaving net earnings of $1,013,000 against $2,000,000 in 1907, a decrease of $1,988,000, or 17 per cent. For the seven months ending January 31, 1908, the net earnings were $14,000,000 against $16,009,000 in 1907, a decrease of 17 per cent.

Camden & Trenton (Electric).—Wilbur F. Sadler, Jr., of Trenton, was, on February 18, appointed receiver of this company by Vice-Chancellor Walker, of New Jersey, on a bill of complaint by former President Henry V. Massey, alleging insolvency and mismanagement. The road is controlled by the New York-Philadelphia Company.

Canadian Northern.—The Canadian Northern is applying to the Parliament of Canada for permission to issue $19,250,000 new stock, increasing its authorized stock to $50,000,000.

Canadian Pacific.—This company has sold $10,000,000 4 per cent. debenture stock in London at a price slightly above par. There was previously $106,045,411 of this stock outstanding.

Delaware & Hudson.—A temporary injunction restraining the company from paying the four quarterly dividends of 2¼ per cent. each (9 per cent. for the year) payable at four different dates during 1908, was given by Judge Platzek in the Court of General Sessions of New York City this week to ex-Judge Rufus B. Cowan, who, at the annual meeting in May, 1907, made an attack on the present management criticising especially the purchases of coal lands, of traction properties about Albany and of railroad properties in Canada.

Erie.—No action was taken on February 19 or on February 26 by the directors on the first preferred dividend. The former is the date on which the semi-annual dividend is usually declared. The question as to whether the company had the right to issue dividends in scrip without the approval of the New York Public Service Commission is still pending.

Illinois Central.—Judge Ball, of the Superior Court of Illinois, on February 20 dissolved the injunction granted on October 14 to Stuyvesant Fish restraining the Railroad Securities Company and the Union Pacific Railroad from voting $28,123,100 Illinois Central stock (29.56 per cent. of the total) held by them at the adjourned annual meeting on March 2. Stuyvesant Fish has sent a letter to the stockholders saying that any stockholders who wish to withdraw proxies given to him may do so on request.

International & Great Northern.—T. J. Freeman, Solicitor of the Texas & Pacific, was on February 26 appointed receiver of this company by Judge McCormick in the United States Circuit Court at Fort Worth, Tex. President George J. Gould issued a statement that the receivership came as a result of orders of the Texas Railroad Commission for extensive improvements at a time when earnings were rapidly decreasing. The International & Great Northern operates 1,160 miles of line, all in Texas.

Interborough-Metropolitan.—President Shonts, of this company, which controls the surface, elevated and subway lines of the borough of Manhattan, New York City, has sent a circular to stockholders summarizing the financial condition of the company for the year ended December 31, 1907. The general balance sheet on that date was as follows:

Assets.		
Interboro R. T. stock, at cost in securities of this company		$104,563,042.00
Metropolitan St. Ry. stock, at cost in securities of this company		68,684,455.00
Metropolitan Securities Co. stock at cost in securities of this company		28,329,695.00
Metropolitan Securities Co. loans, secured by notes and stocks and bonds of subsidiary companies as collateral.		8,844,700.48
Real estate, at cost		594,464.89
Office furniture and fixtures		5,461.06
Engineering in suspense (additional subways)		50,114.78
Metropolitan Securities stock, full paid		36,773.46
Cash and accounts receivable		1,835,802.84
Total		$212,944,509.51
Liabilities.		
Capital stock, common	$100,000,000.00	
Reserved against outstanding stocks not acquired	6,737,808.00	
		$93,262,192.00
Capital stock, preferred	$55,000,000.00	
Reserved against outstanding stocks not acquired	9,260,000.00	
		45,740,000.00
Collateral trust, 4½ per cent. bonds	$70,000,000.00	
Reserved against outstanding stocks not acquired	2,175,000.00	
		67,825,000.00
Notes payable		4,545,000.00
Accounts payable		42,369.76
Accrued interest, 3 mos. to Jan. 1, 1908, on Inter.-Met. 4½ per cent. bonds (covered by dividend of Interborough R. T. Co., paid Dec. 31, 1907)		763,031.25
Profit and loss surplus.		766,916.50
Total		$212,944,509.51

The income of the year, largely made up of dividends on Interborough Rapid Transit and Metropolitan Street Railway stock, was $4,753,561, and the expenses, largely made up of interest on its own bonds and dividends on its preferred stock, were $4,511,569. The surplus for the year therefore was $241,992. This, added to the profit and loss credit balance on December 31, 1906, of $524,924, makes up the profit and loss surplus of $766,916, shown on the balance sheet.

Kansas City Southern.—Gross earnings for January, 1908, were $646,000 against $773,000 in 1907, a decrease of $127,000, or 16 per cent. Net earnings were $203,000 against $320,000 in 1907, a decrease of $117,000, or 37 per cent. For the seven months ended January 31, the net earnings were $1,929,000 against $2,028,000 in 1907, a decrease of $99,000.

Long Island.—In the year ended December 31, 1907, gross earnings increased $535,000 and operating expenses $1,045,000. Net earnings decreased $510,000. In the month of December, 1907, the excess of expenses over gross earnings was $53,000 larger than in the corresponding month of 1906.

New York, Chicago & St. Louis.—Gross earnings for the year ended December 31, 1907, were $10,385,288 against $9,901,947 in 1906. Net earnings were $3,151,549 in 1907 and $2,322,511 in 1906. These are high record figures.

Pere Marquette.—Arrangements have been made for refunding the $2,600,000 5 per cent. equipment bonds maturing March 2, with the same amount of 6 per cent. equipment notes, which are to be redeemed in four annual instalments of $650,000 each, due March 1, 1909-1912 inclusive. These $2,600,000 bonds are the outstanding balance of $3,500,000 five-year equipment bonds issued in 1903 to pay for $5,503,000 worth of equipment, for which $2,103,000 was paid in cash.

Pittsburgh, Cincinnati, Chicago & St. Louis.—Gross earnings for January decreased $506,000; operating expenses and taxes, $375,000, and net earnings, $132,000.

Texas & Pacific.—Estimated gross earnings for the week ended February 31, 1908, were 16 per cent. less than in the corresponding week of 1907.

Union Pacific.—See Illinois Central.